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*A CENTURY OF GEOGRAPHY IN THE UNITED STATES.**

MEN and women occupied with the small and special details of a large and complex work are not well situated for understanding the scope of the large work to which they contribute. The shop girl in Waterbury who spends her days and years in cutting threads on tiny screws may have very limited knowledge and erroneous opinions about the watch industry. The trained arithmetician who spends his months and years in adjusting triangulation or verifying computation does not thereby acquire valuable opinions as to the scope and conduct of a great national survey. In our day many, if not all, branches of human knowledge and activity are widening. As they widen they are specialized. The student of nature, the practitioner of medicine or law, the artisan, each is prone to contract the size of his field of activity and to study more profoundly some small part of the large subject. Even the farms grow smaller and are better cultivated than formerly. Such subdivision of the field of study and activity into special and smaller fields has for a century at least progressed steadily, and the world has gained thereby. Many have become profoundly learned or highly skilled in some small subject. You

* The annual Presidential address before the Philosophical Society of Washington, delivered April 2, 1898.

will recall the story of the German professor who, near the close of a long life devoted to the dative case, regretted that he had chosen so large a field. "I ought," said he, "to have confined myself to the iota subscript." I will not deny—nay, I am persuaded—that the specialization of which I speak is wise, that by it the welfare of the race is promoted. But, while this is so, it should ever be borne in mind that specialized knowledge is not a substitute for general knowledge. It is something called for by the increased and increasing sum of human knowledge; but if by it the number of students of larger and unspecialized fields is greatly reduced harm may, indeed must, result.

My purpose, however, is not to call attention to possible perils from undue specialization, for before this audience that is unnecessary. The subject has been discussed and is well understood.

For many years my work has been along geographic lines, and this has led me to select as the theme for this annual address *the Geography of the United States*—not its mathematical geography, nor its physical geography, nor its political geography, nor its commercial geography, any one of which might be treated with more ease than the general subject. And yet a consideration of the whole field and a picture of the general progress made in the geography of the United States since its creation will, it is hoped, prove profitable—more profitable, indeed, if well done, than a more minute examination of a more limited subject. It is not uncommon when a subject of large scope has been chosen to hear the comment: "He has chosen a large subject," and sometimes we think we see in this an implied opinion that the speaker shows either unwisdom or audacity in such choice. I will not deny that either or both may be true in this case, but will at once invite you to follow me in a most general review of a century's progress in the diffusion of geographic knowledge in and as to the United States.

It is not to the details or agencies by which our knowledge has been acquired that I would draw attention. This has already been done many times. In the stout and repulsive black volumes that for years have, from the government printing office, been poured out over the country without stint or price—in these are set forth with elaborate minuteness the geographic work done by the United States. The particular fields investigated by boundary surveys, by the Coast Survey, by the General Land Office, by the Lake Survey, by the Pacific Railroad Surveys, by the Wilkes Exploring Expedition, by the Rogers Exploring Expedition, by the so-called Hayden, Wheeler and Powell surveys, by the Northern Transcontinental survey, by various State surveys, topographic and geologic, and by the U. S. Geological Survey—all these are duly recorded and published in scores of forbidding black volumes. These volumes record the *increase* in geographic knowledge, but throw little light on its *diffusion*. For *this* we look to the textbooks, to public addresses in Congress and out, to newspaper and magazine articles and to public lectures. These reflect the general knowledge of the community as to geography. This phase of the subject shall be our theme.

It is now one hundred and nine years since thirteen sovereign and independent States, loosely bound together in a confederation, agreed to form a 'more perfect union.' By a narrow majority and after protracted debate they accepted the terms of an instrument which bound them in an indissoluble Union. In April, 1789—one hundred and eight years ago—Washington was inaugurated. That we may clearly note our geographic progress since that event let us picture to ourselves in broad

outline the geographic environment of that time.

The total area of the original thirteen States was 830,000 square miles, an area a little larger than Alaska. The population was about 4,000,000, or a little more than that of Greater New York to-day. Of the whole area only about 30 per cent. contained any population, and even within this area the people were gathered for the most part in a narrow fringe along the Atlantic seaboard. The largest city was New York, with a population of 33,000—*i. e.*, it was about as large as the Yonkers or Youngstown of to-day. Waterbury, Connecticut, with a population of 29,000, is a little larger than was Philadelphia in 1790. Boston contained a population of 18,000; Charleston, South Carolina, 16,000; Baltimore, 13,000, and Salem, Massachusetts, 8,000. After these only thirteen others, all still smaller, find a place in the first census.

Maine was a province of Massachusetts, with a northeastern boundary undefined and awaiting an international boundary conference for its determination. Most of its territory then was, as some still is, barely explored. To the north, then as now, was a British province; to the west and south, Spanish possessions. This phrase 'Spanish possessions' must here be taken in a Pickwickian sense, for these regions owned by Spain were still almost exclusively possessed by the aborigines.

Traveling was chiefly done on horseback and by stages. The days of railroads and steamboats were in the future. Even the system of canals and national highways, so much exploited in the early decades of the century, was not yet begun.

Of maps of the region there were several, fairly good for their time. None of them, however, were based on surveys. The maps of Thomas Jefferys, geographer to King George during the Revolutionary period, are as a whole the best, and fairly representative of the geographic knowledge then existing. While these maps of Jefferys, as well as others, recorded the best geographic information then extant, it does not appear that the information they contained was widely diffused. General ignorance as to geography must have been great. Noah Webster, the lexicographer, writing in 1840, says of the teaching in the schools when he was a boy:

"When I was young, or before the Revolution, the books used were chiefly or wholly Dilworth's spelling books, the Psalter, Testament and Bible. No geography was studied before the publication of Dr. Morse's small books on that subject, about the year 1786 or 1787. * * * Except the books above mentioned, no book for reading was used before the publication of the Third Part of my Institutes, in 1785. In some of the early editions of that book I introduced short notices of the geography and history of the United States, and this led to more enlarged descriptions of the country."

Thus we learn that geography teaching began with a few geographic notes inserted in a spelling book published just prior to Washington's inauguration.

Dr. Morse, to whom Webster here refers, was the Rev. Jedediah Morse, minister of the Congregational church in Charlestown, Massachusetts. He published, in 1789, an octavo volume of 534 pages, entitled 'The American Geography.' This book was, four years later, greatly enlarged and published in two volumes with the title 'The American Universal Geography.' A fourth edition, extensively revised, appeared in 1801 or 1802, a fifth in 1805, a sixth in 1812 and a seventh in 1819. The *fifth* edition of 1805, and presumably all later ones, was accompanied by a little quarto atlas containing about sixty maps and entitled 'A New and Elegant General Atlas,' drawn by Arrowsmith and Lewis.

As a special writer on geography Morse

appears to have been the first American in the field. He continued to write for many years, and after his death the son published revised editions of his father's works. As Morse's geographies, or abridgements of them made by himself or others, were extensively used in the schools, we may now learn from them something of the 'state of the art,' as our patent experts and attorneys would say, of geographic teaching in the early years of the century.

It is worth while to note, in passing, the high esteem in which the work of Morse was held. The numerous editions called for and sold at home, and its translation and sale abroad, attest its value. Samuel G. Goodrich, who wrote so much over the name Peter Parley, referring to his boyhood school days, about 1800 to 1810, in Ridgefield, Connecticut, says:

"When I was there two Webster's grammars and one or two Dwight's geographies were in use. The latter was without maps or illustrations, and was in fact little more than an expanded table of contents taken from Morse's Universal Geography—the mammoth monument of American learning and genius of that age and generation."

The third edition of Morse's abridgement was published in 1791. As to maps it contains only crude diagrams of the world, of the continents and of the United States. For the most part, therefore, it is clear that our grandparents got vague and crude ideas of geographic situation, extent and relation, since clear views of these are not gained without maps—sometimes, indeed, not even with them. The points emphasized by Morse are the points which were of commanding interest and importance in his day.

Fertile soil, healthy climate, but especially transportation routes, are described in general and in particular and are dwelt upon. The facilities which the rivers and lakes afford for commerce impressed our forefathers much more forcibly than even to-day the water routes to the Klondike impress the imagination of the gold-hunter.

You will recall that on the old maps the Ohio river appears as *La Belle Riviere*—the beautiful river. To the French voyageurs *La Belle Riviere* was more than a mere name. Its deep and placid waters, affording an easy and delightful natural highway for a journey almost a thousand miles long, unbroken by falls or rapids, were to them indeed beautiful. Of it Morse says:

"The Ohio is the most beautiful river on earth. Its gentle current is unbroken by rocks or rapids except in one place. It is a mile wide at its entrance into the Mississippi and a quarter of a mile wide at Fort Pitt, which is 1,188 miles from its mouth."

This distance, 1,188 miles, has now shrunk to 965 miles.

As to the Mississippi he says:

"The principal river in the United States is the Mississippi, which forms the western boundary of the United States. It is supposed to be 3,000 miles long and is navigable to the falls of St. Anthony."

In the numerous lakes and rivers scattered over the land Morse saw a bond of union between the future settlers. He points out the ease with which a complete network of waterways might be constructed and its effect. He says:

"By means of these various streams and collections of water the whole country is checkered into islands and peninsulas. The United States, and indeed all parts of North America, seem to have been formed by Nature for the most intimate union. For two hundred thousand guineas North America might be converted into a cluster of large and fertile islands, communicating with each other with ease and little expense and in many instances without the uncertainty or danger of the sea."

The *Western Territory* at this time (1790)

comprised what is now Ohio, Indiana, Illinois, Michigan, Wisconsin and Minnesota. It was practically without settlers. Morse guesses that it contained 6,000 French and English immigrants and negroes. As to this region, but more particularly Ohio, Indiana and Illinois, says Morse:

"It may be affirmed to be the most healthy, the most pleasant, the most commodious and most fertile spot of earth known to the Anglo-Americans. The design of Congress and the settlers is that the settlements shall proceed regularly down the Ohio and northward to Lake Erie."

It will be remembered that at this early date Congress met in Philadelphia. The longitudes given by Morse are reckoned from Philadelphia. Where the future capital of the United States was to be, no one then knew. The selection of the present site was actually made by Congress in 1790. Before Morse had knowledge of such selection he indulged in this bit of speculation as to the future capital. Speaking of the future State of Ohio, then nameless, he says:

"The center of this State will fall between the Scioto and the Hokhoking. At the mouth of these rivers will probably be the seat of government for this State; and, if we may indulge the sublime contemplation of beholding the whole territory of the United States settled by an enlightened people, and continued under one extended government, on the river Ohio and not far from this spot will be the seat of empire for the whole dominion."

As to the region west of the Mississippi, it was then Spanish. Originally French by discovery and occupation, it had passed from France to Spain by cession in 1763. In the light of what it now is, a few words from Morse's speculations in 1791 as to its future throw light on the geography of his time. He says:

"A settlement is commencing, with advantageous prospects, on the western side of the Mississippi, opposite the mouth of the Ohio. The spot on which the city is to be built is called New Madrid, after the capital of Spain. The settlement, which is without the limits of the United States, in the Spanish dominions, is conducted by Colonel Morgan under the patronage of the Spanish King."

New Madrid, Morse thought, was to become a great emporium of trade unless the free navigation of the Mississippi should be opened to the United States, and this, he thought, would not occur without a rupture with Spain.

Some had thought that all settlers beyond the Mississippi would be lost to the United States. Morse discusses this at some length, and concludes with a paragraph which we quote entire:

"We cannot but anticipate the period as not far distant when the American Empire will comprehend millions of souls west of the Mississippi. Judging upon probable grounds, the Mississippi was never designed as the western boundary of the American Empire. The God of Nature never intended that some of the best parts of his earth should be inhabited by the subjects of a monarch 4,000 miles from them. And may we not venture to predict that, when the rights of mankind shall be more fully known—and the knowledge of them is fast increasing both in Europe and America—the power of European potentates will be confined to Europe, and their present American dominions become, like the United States, free, sovereign and independent empires."

These sentiments have ever taken deep root in the United States. When President Monroe, more than a quarter of a century later, wrote the State paper that has forever linked his name with the sentiment: 'America for the Americans,' he did not create or express new or strange doc-

trines, but simply gave expression to an abiding conviction of the American people.

Such in brief is a word picture of the geography of the United States at the beginning. Let us now go forward a generation, to about 1820, and note the changes. Our second and, let it be hoped, last war with Great Britain is over. By the first war political independence was won, by the second commercial freedom. Our ships might now go where and when they would, freed from hateful and hated search by any foreign power. Freedom from dependence on foreign manufactures had taken root and was making vigorous growth. It is difficult to fully realize the burning zeal with which every one was imbued to make the United States dependent upon nothing but itself. It was not enough to be politically free. Freedom was not fully won so long as we were compelled to depend upon foreign powers for anything whatsoever. In the introduction to his little geography of 1791, Morse voices these sentiments. He says:

"It is to be lamented that this part of education (geography) has hitherto been so much neglected in America. Our young men, universally, have been much better acquainted with the geography of Europe and Asia than with that of their own State and country. The want of suitable books on this subject has been the cause, we hope the sole cause, of this shameful defect in our education. Till within a few years we have seldom pretended to write, and hardly to think for ourselves. We have humbly received from Great Britain our laws, our manners, our books and our mode of thinking; and our youth have been educated rather as the subjects of the British King than as citizens of a free republic. But the scene is now changing. The Revolution has been favorable to science, particularly to that of the geography of our own country."

The great lexicographer, Noah Webster, was inspired by the same views when preparing his dictionary; and especially did that great democrat, Jefferson, strive unceasingly to complete the independence of which the political part was definitely secured by the peace of 1783.

He would not have us reckon our longitude from a foreign meridian, or depend upon a foreign country for an ephemeris or for coast charts. Accordingly, in 1804, a meridian through the Executive Mansion was surveyed and marked on the ground as the first meridian of the United States. The name Meridian Hill survives in testimony of this. In 1807 the Coast Survey was created to accurately chart our coasts for purposes of commerce and defense, and in 1804 the famous expedition of Lewis and Clarke to the Pacific ocean expanded our political and mental horizon in matters geographic. A great system of national highways, both roads and canals, was projected and pushed forward. The practical introduction of steamboats stimulated progress. Lake Champlain was connected with the Hudson by a canal, while work upon 'Clinton's ditch,' or the Great Western Canal, as the Erie Canal was then called, was being pushed forward with great energy. The object of this canal, as Morse tells us, was 'to turn the trade of the western country from Montreal to New York.'

In 1791 there were only 89 post-offices in the United States. Twenty-five years later, in 1817, there were 39 times as many, 3,459. Each day in the year (1791) the mails were carried 10,000 miles by stages and 11,000 on horseback and in sulkies. Mail was carried along one continuous route from Anson, in the district of Maine, via Washington, D. C., to Nashville, Tennessee, 1,448 miles; another mail route was from St. Marys, Georgia, via Washington, D. C., to Highgate, in Vermont, 1,369 miles. These were the longest mail routes in the United States. Postage stamps were

not yet invented, and the postage on each letter, which was limited to a single sheet of paper, was 25 cents.

The beginning of the third decade, or about 1830, may be regarded as marking the decadence of that grand scheme of internal communication by canals and national highways which had hitherto filled the imaginations of statesmen and publicists. The railroad had been born and a revolution had begun, the end of which not the wisest could or can foresee. To this railroad system were we indebted, and we are still indebted, for a stimulus to geographic research which has continued undiminished to our own day.

The twelfth edition of a school book on geography by Daniel Adams appeared at Boston in 1830. This book appears to have been revised and brought down to 1827. A few extracts from it will give a picture of the geographic knowledge then existing. He says:

"Vessels are from 5 to 30 days on their passage up to *New Orleans*, 87 miles, although with a favorable wind they will sometimes descend in 12 hours. From New Orleans to Natchez, 310 miles, the voyage requires from 60 to 80 days. Ships rarely ascend above that place. It is navigable for boats carrying about 40 tons and rowed by 18 or 20 men to the falls of *St. Anthony*. From New Orleans to the Illinois the voyage is performed in about 8 or 10 weeks. Many of these difficulties, however, now are overcome and much is gained by the successful introduction of steam navigation."

The children in our schools to-day are asked, among other things, to set forth the advantages for commerce possessed by the Western States. This is the answer to that question which Mr. Adams furnished to their grandparents. As to these Western States, which comprise all west of the Alleghany mountains, he says:

"The remote situation of this country from the seaboard renders it unfavorable to commerce. This inconvenience, however, is in some degree remedied by its numerous large and navigable rivers, the principal of which is the Mississippi, the great outlet of the exports of these States; but such is the difficulty of ascending this river that most of the foreign goods imported into this country have been brought from Philadelphia and Baltimore in wagons over the mountains, until the invention of steamboats, by which the country now begins to be supplied with foreign goods from New Orleans."

The following passage, also from Adams, throws strong light on the knowledge current in 1827 as to the great prairies of the West:

"Pilkava prarie or plain is a high, level ground in this State (he is speaking of Indiana), seven miles long and three broad, of a rich soil, on which there was never a tree since the memory of man. Two hundred acres of wheat were seen growing here at one time a few years since yielding fifty bushels on an acre."

Missouri Territory at this time, so wrote Adams:

"Extends from the Mississippi on the east to the Pacific ocean on the west, and from the British possessions on the north to the Spanish possessions on the south."

In all this great region the only features mentioned by Adams are the Mississippi, Missouri and Columbia rivers, the Rocky mountains and Astoria. St. Louis, with a population of 4,600, was the center of the fur trade. Similarly Detroit, in Michigan Territory, with a population of 1,400, was a fur-trading station, while western Georgia was still in possession of the Indians called Creeks, 'the most warlike tribe this side the Mississippi.'

"The White mountains," he tells us, "are the highest not only in New Hamp-

shire, but in the United States. Mt. Washington, the most elevated summit, has been estimated at about 7,000 feet above the level of the sea."

Finally, as to Alaska the golden, from which so much of wealth and of disappointment is to come, our author couples it with Greenland and dispatches it in this one sentence:

"There are also Greenland, on the northeast (of North America), belonging to Denmark, and the Russian settlements on the northwest, both of small extent and little consequence."

These citations serve to indicate the horizon of geographic knowledge 70 years ago, a horizon which was steadily widening. Stories of wondrously fertile lands west of the Alleghenies found their way to the rocky and sterile farms of the East, and a steady stream of migration to better lands, where the struggle for existence should be less severe, poured over the Alleghenies and onward toward the sunset. In the vanguard was the government surveyor measuring out the land and subdividing it for farms. Working hurriedly in a wilderness, among native tribes not always friendly, his surveys were not, perforce, accurate, nor indeed was it important they should be. They yielded a basis for titles to homesteads and for clear and easily understood descriptions. The results of these subdivisional surveys constitute substantially the only bases for the maps for much the greater part of all of our 'Great West' to this day.

Already before 1840 the question of supremacy of canal or railroad had been settled. In Peter Parley's geography of 1840 a tabular exhibit of railroads and of canals in the United States shows that there were then 46 canals, with a total mileage of about 4,800 miles, and 88 railroads, with a total mileage of nearly 7,700 miles. Progress in railroad-building demanded surveys and maps. Accordingly these were made; knowledge of geography was increased, and increased at a rapid pace. Whenever a little known region is found to possess wealth or the means of its rapid acquirement, knowledge of the geography of that region increases extraordinarily fast. Witness the increase and diffusion of knowledge as to Alaska in the past twelve months. The peaceful expanding of our horizon of geographic knowledge continued steadily and uniformly. But crises in human affairs sometimes hasten progress; wars, rumors of wars even, sometimes make possible the seemingly impossible.

The northern boundary of the United States, from Maine to the crest of the Rocky mountains in Montana, as we now see it on the maps, was definitely settled in 1842. For more than half a century prior to that date this frontier had been in dispute between Great Britain and the United States. Repeated attempts to settle it had met with repeated failure. Boundary disputes, as we know, are ever long-lived and bitter. In April of the year 1842 Lord Ashburton arrived in Washington with full power to negotiate a treaty for settling this old and irritating controversy. Webster was then Secretary of State in the Cabinet of President Harrison. Before the year had ended, a treaty, now known as the Webster-Ashburton treaty, had been drafted, agreed to, signed, ratified and proclaimed as the law of the land. Webster regarded this settlement as 'the greatest and most important act of his eventful life.' That the settlement was just may be inferred from the fact that it displeased both parties and both Webster and Ashburton were criticised at home for sacrificing the interests of their respective countries.

But this treaty line stopped at the crest of the Rocky mountains and immediately there arose the Oregon question. That

question was whether Great Britain or the United States owned the territory which now comprises western Montana, Idaho, Oregon, Washington and British Columbia. Much bitterness and angry contention followed before the 49th parallel was, in 1846, finally agreed upon as the boundary. The debates in Congress and in Parliament during the years 1842–1846, and articles in leading journals and reviews, after generously discounting their partisan overstatement, clearly portray the then prevailing knowledge, or rather, should I not say, the prevailing ignorance, as to the whole region west of the Mississippi.

Mr. Winthrop, of Massachusetts, in 1844, in the House of Representatives, cited with approval these words spoken by Benton, in the Senate, in 1825:

"The ridge of the Rocky Mountains may be named without offence as presenting a convenient natural and everlasting boundary. Along the back of this ridge the western limits of the Republic should be drawn, and the statue of the fabled god Terminus should be raised upon its highest peak, never to be thrown down."

On January 25, 1843, Senator McDuffie, of South Carolina, speaking of the country now embraced in the two Dakotas, Nebraska, Kansas, and thence northwestward to Oregon and Washington, said:

"What is the character of this country? Why, as I understand, that seven hundred miles this side of the Rocky Mountains is uninhabitable, where rain scarcely ever falls—a barren and sandy soil—mountains totally impassable, except in certain parts. Well, now, what are we going to do in such a case as that? How are you going to apply steam? Have you made anything like an estimate of the cost of a railroad running from here to the mouth of the Columbia? Why, the wealth of the Indies would be insufficient! You would have to tunnel through mountains five or six hundred miles in extent. Of what use will this be for agricultural purposes? I would not, for that purpose, give a pinch of snuff for the whole territory. I wish it was an impassable barrier to secure us against the intrusions of others. If there was an embankment of even five feet to be removed, I would not consent to expend $5 to remove that embankment to enable our population to go there. I thank God for his mercy in placing the Rocky Mountains there."

A writer in the *Westminster Review*, in 1846, thus describes the great plains of Nebraska, Kansas and Oklahoma:

"From the valley of the Mississippi to the Rocky Mountains the United States territory consists of an arid tract extending south nearly to Texas, which has been called the Great American Desert. The caravan of emigrants who undertake the passage take provisions for six months, and many of them die of starvation on the way."

Indeed, the question much debated at the time was: Is Oregon worth saving? Both Winthrop and Webster were of opinion that the government would be endangered by a further enlargement of territory. Mr. Berrien declared that the region under discussion was a barren and savage one, as yet unoccupied, except for hunting, fishing, and trading with the natives, while Mr. Archer said the part near the coast alone contained land fit for agricultural purposes, and there were no harbors which were or could be rendered tolerable. And yet, out of all this hot debate and war talk, there emerged in 1846 peace, Oregon and the forty-ninth parallel. And out of all the ominous mutterings in 1898, and the fever heat that is now at the danger line, there will emerge—I am not a prophet, but let us hope, there will emerge—white-winged peace, honorable to Spain and to us, justice for all, and freedom for Cuba.

Three years later came the discovery of gold in California. Then California, as now

Klondike, set the imaginations of men on fire. Long caravans of ox teams in endless succession wended their slow way across the plains, the mountains and the deserts to the sunset land of gold. Government surveys for a railroad promptly followed, and crude and imperfect knowledge as to the region rapidly gave place to better, though still defective, knowledge of the *Great West*.

Then came war and the need of war maps. All available agencies for their production for the use of army and navy were drawn upon, and the need of topographic maps for military purposes, hitherto clear to the few, was now made clear to the many.

In the years immediately following the Civil War several events occurred which gave a fresh impetus to geography. The completion of a railroad across the continent had a profound significance and importance. It was a bond of iron which, shortening the time and distance between East and West, bound them closer in ties of affection and interest. The Western pioneer of '49 and '50 could revisit his old home and friends in the East, and opportunity was afforded to many in the East to get some personal knowledge of the boundless West.

In 1867 Alaska was purchased. The discussions in Congress and out preceding and following that purchase were spread abroad and taught Alaskan geography to the masses; and yet there was little to teach, for but little was known. The government, the great agency of geographic research in this country, at once began to explore its new purchase, to survey and to map it. This work has, with varying vicissitudes, continued to this very year, when the work of exploration and survey is, under the stimulus of gold discoveries, being conducted on a scale never hitherto attempted there. It was in that same year, 1867, that Major J. W. Powell made his adventurous voyage down the Colorado river and brought the world its first clear knowledge of the *Grand Cañon*, greatest of all Nature's wonders in our land. It was shortly after this that from the Hayden Survey came tidings of that region of wonders—the Yellowstone Park.

In the thirteen years immediately following the Civil War three national surveys were engaged in the West in gathering information as to the character and extent of the natural resources of the Western Territories—Territories, for the most part, then containing few inhabitants but Indians. The rise of these surveys was rapid, the results secured interesting and valuable, and their rivalry and clashing inevitable. Many thousands of square miles of territory were roughly mapped out, and many books and reports, both popular and scientific, were produced.

In 1878 a reorganization was proposed and the National Academy of Sciences asked to submit a plan. This it did, and submitted it to Congress. The outcome was the present United States Geological Survey, created in March, 1879. It replaced the prior organizations, familiarly known as the Hayden, Powell and Wheeler Surveys.

The work laid out for the newly-created Geological Survey was geological, and its field the *national domain*. What is the *national domain?* Is it restricted to the Territories and places actually occupied by the United States, or does it embrace every spot where the Stars and Stripes may float? Congress, after a long debate, answered this question and authorized surveys to be made in every part of our whole Union. Again, geological investigations can not be satisfactorily made, nor geological results satisfactorily exhibited, without maps, topographic maps—*i. e.*, maps which show the shapes and forms as well as positions on the

surface. Such maps did not exist. A fragment here and there, to be sure, existed —a fringe of sea and lake coast; but these constituted only a bare beginning. Accordingly, in 1882 authority was given and the beginning of the mighty task of making a topographic map of the United States was begun. That work has for sixteen years progressed without interruption, and to-day we have contour topographic maps covering more than 600,000 square miles. In almost every State and Territory in the Union work has been done, while Massachusetts, Connecticut, Rhode Island, New Jersey and the District of Columbia are completely mapped.

That the prosecution of this work and the distribution of the maps has profoundly influenced interest in and knowledge of geography in the United States goes without saying. These maps are in the hands of engineers, of projectors of improvements, of teachers, of text-book makers, and of geographic students everywhere. The standards of school geographies have risen, methods of geographic teaching have been changed, and a better understanding of the relations of environment produced.

And thus the first century of progress in geography ends with a rate of progress, both in research and teaching, never surpassed. That which has been already accomplished is great; yet it is but a small part of that which remains to be done.

MARCUS BAKER.

U. S. GEOLOGICAL SURVEY.

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*ON THE INHERITANCE OF THE CEPHALIC INDEX.**

(1) THE cephalic index, when used to test any theory of heredity, possesses many merits, and at the same time one or two defects. In the first place it is supposed to be a marked racial character, and, therefore, might be considered to be strongly inherited. In the next place it remains sensibly constant after two years of age; thus the strength of inheritance can be ascertained by measurements on young children, whose parents are more frequently alive than if we have to wait for measurement till the offspring are of adult age. Further, although the cephalic index requires a more trained hand to measure it than some other measurements on the living subject, the trained observer will always deduce sensibly the same results;* on the other hand, stature measurements vary sensibly with the hour of the day and with the observer. The need of a moderately trained observer is the chief defect of cephalic index measurements; it hinders the rapid collection of numerous family measurements; the difficulty, further, of satisfactorily measuring the female head without some derangement of the toilet is a further hindrance.† The merits of the cephalic index, however, as a test of heredity far surpass its demerits. A well-organized measurement of the cephalic index in pairs of relatives would probably give the best results available for the laws of inheritance. The cephalic index measured on the living head is, of course, not so satisfactory as that measured on the skull, but the latter may be considered, even with the aid of Röntgen rays, as at present quite out of the question. The following paper has been worked out, not on very good material or on material collected with the present end in view, but on the only material that seemed at present available. It suffices

* 'Mathematical Contributions to the Theory of Evolution.' By Miss Cicely D. Fawcett, B.Sc., and Professor Karl Pearson, M.A., F.R.S., University College, London. Read before the Royal Society, February 17, 1898.

* This has been tested by frequent measurements of the same heads.

† The recent establishment of an anthropometric laboratory at Newnham College will, it may be hoped, remove the difficulty about head measurements on female students felt by the Cambridge Anthropmetric Committee.

to justify the view that the inheritance of the cephalic index offers a most satisfactory method of testing the laws of heredity.

(2) Owing to the kindness of Mr. Francis Galton, the Department of Applied Mathematics in University College, London, was placed in communication with Dr. Franz Boas, of the American Museum of Natural History, who is well known for his elaborate system of measurements on North American Indians. With extreme kindness, Dr. Boas* at once forwarded to England upwards of 1,000 sheets of measurements on comparable Indian tribes. These tribes, however, contain extremely mixed blood. In the fewest cases were pure Indian ancestors noted; one of the grandparents at least exhibited, as a rule, European blood —English, Dutch, French, Irish, etc. Dr. Boas himself writes:

"I could not give you any series that was sufficiently extensive and embraced pure Indians only, because among these tribes the determination of relationships offers peculiar difficulties. I am afraid that your results may also bring out the looseness of family relations. I should not be surprised if the relation between father and child were much lower than that between mother and child, because often another person is actually the father of the child."

Dr. Boas's last surmise is amply verified; it will be found from the table below that the coefficient of heredity between father and son is abnormally small, while that between father and daughter is actually less than the probable error of this series of measurements! If we put upon one side any purely hypothetical supposition that illegitimate births are more likely to be female than male there would seem reason to suppose some native custom by which it is held less discreditable to pass off a daughter than a son upon the titular husband. It may be asked whether, if the racial mixture is so great and the paternity so obscure, it was worth while to undertake the lengthy arithmetic* required to determine the heredity correlations. The answer is threefold: (*a*) if Galton's law of ancestral heredity be correct, inheritance is not a racial character, but a general law of living forms, and racial mixtures will not influence the result; (*b*) the results show that obscure paternity does not prevent good values being found for other relationships; in fact, the fulfilment of Dr. Boas's surmise is in itself not without value, as showing how well our algebraic theory fits itself to the facts; it might almost be said to provide a scientific measure of the conjugal fidelity of a race; (*c*) it is always worth while to undertake an investigation on the best material available, even if it be poor material for this purpose, for it emphasizes the need of new and more elaborate observations.

(3) It will be seen from the table that it has only been possible to determine the coefficient of heredity for small series, varying from 80 to 143 pairs of the seven relationships, four corresponding to the first degree of direct kinship and three to the first degree of collateral kinship. The probable errors are, as might be expected from such small series, large. Putting aside the paternal relationship, we are justified in drawing certain general conclusions, which may be thus summed up:

(*a*) The coefficients of heredity, as dedetermined from the cephalic index, differ in all cases from those determined for stature by less than their probable error and, therefore, by less than the probable error of their difference. The stature coefficients were obtained for the English

* It is difficult to sufficiently emphasize the disinterested service to science of men who do not 'monopolize' their anthropometric measurements.

* We have to thank Mr. Leslie Bramley Moore for much aid in extracting the head measurements from the slips and calculating cephalic indices.

middle classes.* We thus conclude that these results confirm Galton's law in so far as they tend to show that the strength of *inheritance is not a character of race or organ.* They do not, however, exceed the limits of errors of observation. In the case of mothers and sons the divergence is very slightly above the probable error; the ob-

INHERITANCE OF CEPHALIC INDEX—TABLE OF VALUES.

Relation.	No.	Mean.	S. D.†	Coefficient of correlation.		
				Cephalic Index.	Stature.	Theory.
Fathers	131	80.55±0.18	3.064±0.128	[0.2245±0.0560]	0.3959 ±0.0259	0.3000
Sons	131	81.53±0.20	3.432±0.143			
Fathers	108	80.41±0.22	3.428±0.158	[0.0490±0.0647]	0.3603 ±0.0276	0.3000
Daughters	108	81.90±0.26	3.976±0.182			
Mothers	104	80.80±0.20	3.020±0.141	0.3696±0.0571	0.3018 ±0.0279	0.3000
Sons	104	81.55±0.23	3.524±0.165			
Mothers	82	80.88±0.28	3.843±0.202	0.3000±0.0603	0.2841 ±0.0292	0.3000
Daughters	82	81.53±0.31	4.143±0.218			
Brothers	139	80.57±0.19	3.652±0.136	0.3787±0.0490	0.3913 ±0.0232	0.4000
Brothers	139	81.42±0.21	3.765±0.152			
Brothers	143	81.58±0.20	3.490±0.139	0.3400±0.0499	0.3754 ±0.0170	0.4000
Sisters	143	81.38±0.20	3.588±0.143			
Sisters	80	82.10±0.27	3.636±0.194	0.4889±0.0574	0.4436 ±0.0222	0.4000
Sisters	80	81.84±0.16	4.069±0.217			

Cephalic index is clearly not more strongly inherited than stature. Its variability is also very much that of stature. It is accordingly difficult to see why it should be considered as peculiarly a racial character.

(*b*) The divergencies between the observed values for the coefficients of inheritance for the cephalic index and the theoretical values obtained on the basis of Galton's law of ancestral heredity are greater than the divergencies between the former and the coefficients for stature.‡ served and theoretical values are identical in the case of mothers and daughters; they are less than the probable error for brothers and brothers and only slightly larger than it for brothers and sisters; for sisters and sisters the divergence is about one and a-half times the probable error. The mean weighted values of the coefficients for direct and collateral kinship are 0.3366 and 0.4004, the former differing by less than half its probable error from the theoretical value 0.3000, and the latter sensibly identical with its theoretical value, 0.4000.

We conclude, therefore, that Galton's law of ancestral heredity gives values for the inheritance within the limits of the probable errors of observation. But,

(*c*) As in the case of stature there is, on

* *Phil. Trans.*, Vol. 187, A, pp. 270–281.

†S. D. = standard-deviation or 'error of mean square.'

‡It is to be noted that, putting paternity aside, the order of relative magnitude of the coefficients of heredity is precisely the same for both cephalic index and stature.

the whole, a tendency of the coefficients for cephalic index to be somewhat greater than their values as given by Galton's law. It is, therefore, reasonable to suppose that the heredity constant γ (introduced in a paper 'On the Law of Ancestral Heredity') is not, as Mr. Galton takes it, unity, but has some slightly less value.

Other conclusions which may be drawn from the above table are:

(*d*) Among Indians of mixed blood the women are more brachycephalic and more variable than the men. This is in accordance with the general conclusion reached in a paper on 'Variation in Man and Woman,'* namely:

"The lower races give us results in sensible accordance with those we have drawn from the data for ancient civilizations, namely, the women are on the whole more brachycephalic and slightly more variable than the men."

(*e*) The younger generation is more brachycephalic and more variable than its parentage.

The whole of this difference can hardly be due to any change of shape of the skull with old age, for the majority of parents had in this case not passed the prime of life. It may be due to (i) a correlation between dolichocephaly and fertility or between dolichocephaly and philogamy, or (ii) more probably to the action of natural selection (results obtained, but not yet published, by the present writers show a correlation between physique and cephalic index), or (iii) to a greater or less admixture of white blood in the younger generation.

(*f*) Parents of sons are significantly less variable than parents of daughters. This is in accordance with the result previously obtained that mediocre fathers are likely to have sons,† but disagrees with the result for stature—based on a far smaller probability—that mediocre mothers are likely to have daughters.

The conclusions of this paper, while appearing to the writers of interest, are to be taken, in the first place, as *suggestions* for much larger series of measurements and for new lines of investigation.

* Pearson, 'The Chances of Death,' Vol. 1, p. 370.

† '*Phil. Trans.*,' Vol. 187, A, p. 274.

A COMPLETE SKELETON OF TELEOCERAS THE TRUE RHINOCEROS FROM THE UPPER MIOCENE OF KANSAS.

Together with the very full series of Upper Miocene skulls in the American Museum a complete skeleton of a rhinoceros representing an aged female of very large size, has recently been mounted. We used from materials belonging to several individuals secured by our excavations in Phillips Co., Kansas, under the direction of Dr. Wortman in the months of September, October and November, 1894.

The writer's attention was first drawn to the largely disregarded sexual and age characters of fossil Ungulates in studying the group of Titanotheres; the extinct rhinoceroses conform to the laws which were observed in that group, and which are familiar enough among living types, namely: males, of larger size with more robust and rugose skulls; horns, if present, more prominent; canines largely developed; incisors and anterior premolars disappearing in adults. By the comparison of the 16 skulls and 13 jaws, representing both sexes and all stages of growth, we are enabled for the first time to define positively the animal long known as *Aphelops fossiger*, to distinguish it both from *Rhinoceros* and *Acerotherium*, and to point out its important sexual and individual variations.

We owe to Hatcher the valuable demonstration that *Aphelops fossiger* bore a terminal horn upon the nasals, although he assigned this character to a type which he supposed represented a new species, namely,

Teleoceras major. Hatcher's type of *T. major* proves to be a middle-aged male of *A. fossiger*, and his distinction of *Teleoceras* as a genus supersedes *Aphelops* Cope, because Cope originally applied the term *Aphelops* to *A. megalodus*, defining it as an Acerathere with only three premolar teeth in the lower jaw. This is true of the type species (*A. megalodus*), but this species should, so far as we know at present, be referred to the genus *Aceratherium*, in which the lower premolars vary from four to three in number according to age and individual variation, as in the living rhinoceros.

Our abundant material proves not only that *Teleoceras* is a rhinoceros with a median horn on the tips of the nasals, but that it is fully distinguished from the genus *Rhinoceros* as follows:

	Horns.	Lower Premolars.	Digits.
Genus *Rhinoceros*	Upon anterior portions of nasals	4 in young, 3 in aged individuals	3-3
Genus *Teleoceras*	Upon tips of nasals	3 in young, 2 in aged individuals	3-3

The reduction of the lower grinders to 5 in *T. fossiger* (as compared with 6 in *Rhinoceros*) is a very important and distinctive character, as it absolutely excludes *Teleoceras fossiger* from the ancestry of any of the modern rhinoceroses, and shows it to have represented a distinct side phylum.

EXCAVATION OF THE SKELETON.

The Phillips County Quarry, near Long Island, Kansas, was discovered in 1883 by Mr. Charles Sternberg, who collected for the University of Kansas and for the Harvard University Museum. From the latter collection Scott and Osborn procured materials for the restoration which they published in 1890. Subsequent collections were made by Sternberg and Hatcher for the United States Geological Survey, between 1884 and 1886. Later Professor Cragin collected here, and in 1891 Mr. E. P. West, of the University of Kansas, aided by Mr. T. R. Overton, began the extensive collections which led to the preparation of the skeleton for the University under the direction of Professor Williston. This skeleton, as mounted in the Kansas Museum and described by Williston, gives a much more accurate idea of this animal than the previous restoration by Scott and Osborn, in which the chest is represented as far too shallow.

Its principal dimensions are as follows: Length, not including tail, 9 ft.; height, 4 ft.; greatest girth, 9 ft. 4 in.

The measurements of the American Museum skeleton as mounted are: Length, 10 ft. 2 in. to bend of tail; height at withers, 4 ft. 1 in.; greatest girth, 9 ft. 2 in.

From the above accounts, and especially from our own observations, it is seen that this quarry represents the deposit of some stream or small river along which the rhinoceroses herded in great numbers. In this typical bone-bed are mingled individuals of both sexes and of all sizes, and the proximity of one specimen to another is not a certain guide. There are certain spots, however, where considerable portions of individual skeletons have drifted together. We associate the skull and pelvis in our mounted specimen, for they are of similar age and were found within about six feet of each other, the skull being that of a fully adult female, and the pelvis indicating a corresponding age, because the ilia are united above the sacrum; with the pelvis, moreover, was found a part of the jaw belonging to the skull; also with this pelvis belong a femur, tibia and fibula, astragalus, calcaneum and cuboid of one side, several metacarpals and metatarsals and two cervical vertebræ. The selection of the other limb and foot-bones was made from these as a guide.

Similarly about 300 feet distant were found the principal ribs which have been selected for this mount, characterized by the very rugose appearance and oblique lines for the insertion of the abdominal muscles (*sacro-lumbalis*, *longissimus dorsi*). Near these ribs were large jaw and limb-

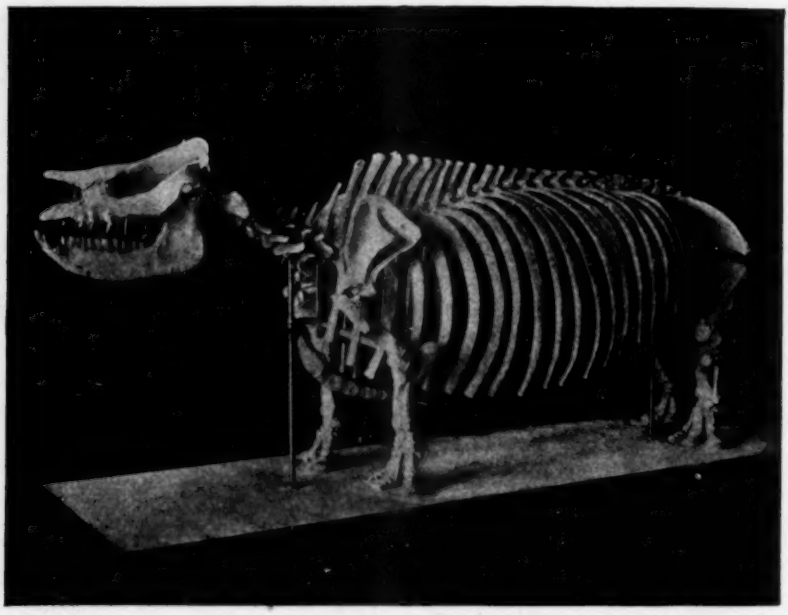

Fig. 1.—Mounted Skeleton of *Teleoceras fossiger*, one-twentieth natural size.

bones corresponding in size with those placed in the mounted skeleton. Apart from these probable associations, the main principle of selection adopted throughout has been that of the age and size standard, after a careful comparison of all the elements. In each region the largest and oldest bones were chosen. Upon this principle the ribs are shown to be of very great length; the chest girth exceeds that indicated in the Scott-Osborn restoration and equals that in the mount in the Kansas Museum, which has heretofore appeared extreme. In additional support of this correlation of material belonging to different individuals, this bone-bed gives evidence of the existence of only one species of rhinoceros, namely, *T. fossiger*. All the differences observed are due to growth, individual and sexual variations, as set forth below.

Comparative Measurements.

	Teleoceras fossiger.		*Rhinoceros indicus.*	
	Feet.	Meters.	Feet.	Meters.
Total length to bend of tail	10. 2	3.10	10.8	3.05
Height, skull	4. 1	1.23		
" withers	3.11½	1.21	5.6½	1.69
Breadth, across pelvis	2.10	0.87	2.8	0.82
" " ribs	2.11	0.89		
Fore limb, total flexed (ball of hum vert. to ground	2. 4⅝	0.7	3.5	1.04
Hind limb, total flexed (ball of femur vert. to ground.	2. 7½	0.80	3.8½	1.13

From the above measurements it appears that from head to tail *T. fossiger* is only six inches shorter than *R. unicornis*, while the back is eighteen inches (.580 mm.) nearer

the ground. This remarkable lowering of the trunk is chiefly caused by the great reduction of the fore arm, fore leg and metapodials. The humerus and femur are respectively only 90 and 110 mm. shorter than in *R. unicornis*, while the radius and tibia (typically shorter elements) are respectively 140 and 130 mm. shorter, and the metacarpals and metatarsals are respectively 90 and 950 mm. shorter. This limb reduction is very striking. At the same time the abdominal girth exceeds that of *R. unicornis*, justifying Cope's conclusion that this animal had rather the proportions of the hippopotamus than of the rhinoceros. It will be recalled that *R. unicornis* has a lower abdominal line than *R. sondaicus* or *R. sumatrensis*, or than either of the African rhinoceroses. *T. fossiger*, therefore, had a totally different external appearance from any existing form.

R. unicornis, although less pitched forward. The limbs are much shorter than in any living type, and, as pointed out by Pavlow, at once recall those of *R. brachypus* and *R. aurelianensis*. A further comparison of *T. fossiger* strengthens the resemblance to the latter form. The proportions of the skull, limbs and metapodials are very similar. In both the cnemial crest of the tibia is double; the secondary folds of the superior molars are similar, as well as the general form of the skull.*

HENRY F. OSBORN.

A NATURAL BRIDGE IN UTAH.

THE remarkable natural bridge illustrated in this article has, so far as I know, never been called attention to before, and is, therefore, entitled to rank as a new discovery among the curiosities of nature. It is an object rivaling the celebrated natura

FIG. 1.

It may be briefly characterized as a brachycephalic, extremely short-limbed rhinoceros, partly aquatic in its habits, with a very large brain and no diploë of the skull. It parallels the African rhinoceroses *R. simus* and *R. bicornis*, in the form of the humerus, femur and atlas, and in the terminal position of the nasal horn. The occiput, however, is widely different from that of the African rhinoceroses, as well as of *R. sumatrensis*, resembling rather that of

bridge of Virginia in magnitude and even exceeding that classic in interest when one considers its probable origin.

The view was taken in southeastern Utah not far from Moab, on the Grand River, in the midst of the great arid region lying west of the Rocky Mountains and some fifty miles from any railway. It was not my good fortune to be able to visit the lo-

* Bulletin American Museum of Natural History, March 18, 1898.

cality myself, but the prints were obtained by me from the original photographer in Moab, when on a somewhat hurried return from a mine examination in the Blue Mountains to the south. The dimensions of the bridge, as estimated by the photographer, are about 500 feet in span and about 150 feet in height. A comparison of the bridge with figures shown in the original photograph in the right-hand corner and with the tree growth near by indicates that these dimensions are quite possible.

The bridge is, in all probability, a monstrous product of wind erosion. The rock appears to be one of the friable Mesozoic sandstones which are widely exposed in this region. Other examples of wind action, such as is illustrated in figure 2, were seen

Fig. 2.

by me while travelling through the country, so located that no other cause could be assigned. Strong and prolonged winds are frequent here, as any one who has sojourned in that country can testify to his misery. The sands carried by these winds are whirled about in the depressions of the rocks, and excavate wind pot-holes in the friable sandstones with great rapidity. A wall or slab of such rock is by degrees entirely penetrated, giving rise to the so-called window rocks which are frequently seen in isolated buttes high above the surrounding level. Our natural bridge, I conclude, is simply an extreme or abnormal enlargement of such a 'window.' Possibly some water channel may have assisted in the process, but the view does not indicate this, but shows the bridge to be high above the main water course. The dimensions of the bridge, or rather the shape of the space covered by it, are also against this idea, as the ordinary channel cut by a stream through rock is deep and narrow.

Arthur Winslow.

Kansas City, Mo.,
February 25, 1898.

FIFTH ANNUAL RECEPTION AND EXHIBITION OF THE NEW YORK ACADEMY OF SCIENCES.

The fifth annual reception and exhibition of the New York Academy of Sciences, of which notice has already been made in Science, was held in the American Museum of Natural History, April 13th and 14th, and proved to be the most satisfactory and successful of all receptions thus far given by the Academy. The number of exhibits was not as great as heretofore, but was arranged to show the progress of the last year more carefully than had been the custom previously. Hence the exhibit, as a whole, was worthy of detailed attention in every department and received such attention from the several thousand people who were present during the two evenings and one afternoon on which the reception was held. Beside the exhibit of progress in some fifteen departments of science, of which more particular mention will follow, the program included an address on the second evening by Professor George E. Hale, of the Yerkes Observatory, on the 'Functions of Large Telescopes,' which will appear in a later number of this Journal. Mr. C. E. Tripler gave several demonstrations of the properties of liquid air to an astonished and appreciative audience. Indeed, liquid air was the exhibit of the reception concerning which the most questions were asked.

It would be difficult to notice in a short account like this all the important exhibits that ought to be mentioned from a scientific standpoint. In fact, each department contained materials which were praised most highly by those qualified to give praise from a scientific standpoint. As one entered the large hall one was greeted with a magnificent display of the astronomical results of the year, including photographs of the moon, stellar spectra, etc., which attracted a great deal of attention from the many astronomers present. On the right was to be seen the equally attractive exhibition of paleontology, including the several fossil reptiles which were unearthed last year by the American Museum of Natural History, and which are the greatest finds in vertebrate paleontology thus far made by this institution in the far West. The other exhibits in the outer hall included chemistry, philology, mineralogy, experimental psychology and ethnology. The exhibit in philology was large and comprehensive, and received a good deal of attention. This is the first time that this department has ever made an exhibit, although there has been a Section of Philology in the Academy for some time. The exhibit in experimental psychology included several instruments for psychological measurements, exhibited by Professors Cattell, Bliss and others. The exhibit in ethnology contained a few of the best results obtained by the Jesup North Pacific Expedition during the last year, and illustrations of symbolism of the Huichol Indians of Mexico. In chemistry, beside the exhibit of liquid air, the representation and processes of dyeing from the Columbia Laboratory, and the more recent results in the artistic coloring of glass from Tiffany & Co., received the most attention. The exhibit in mineralogy was very carefully arranged, and included some very wonderful crystals, and several minerals from Tasmania and New South Wales, exhibited by Dr. A. E. Foote.

In the second hall devoted to the exhibit was found on the right, first, the exhibit in botany, largely devoted to microscopical and other preparations in morphology, and the exhibition of new species and genera from various parts of the United States. Indeed, several hundred feet of wall space were attractively and artistically covered with herbarium specimens illustrating these points. In anatomy the large series of preparations of the anatomy of reptiles exhibited, by the Department of Anatomy of Columbia University, was striking, as showing the latest results in staining, preparation and mounting. An equally attractive exhibit was made in the department of zoology, including the results in insect coalescence, on the several Puget Sound expeditions of Columbia University, and the expedition to Bermuda of the New York University in 1897. On the same side of the hall there was a good-sized exhibit in photography, including an illustration by lantern of colored photography, and the latest papers and developers and their results.

On the other side of the hall, as one entered, was to be seen the large exhibit in geology, in which mention should be made of the clays and other specimens from Europe collected by Dr. Heinrich Ries in his studies of kaolins and clays abroad. The most beautiful exhibit was that of the leucite and trachytic rocks of the Italian peninsula, of Mr. Henry S. Washington, of Locust, N. J.; also photographs and specimens illustrating recent experiments in compression and flowage of marble carried on at the McGill University, Montreal, should be mentioned. The exhibit in physiography included a large number of maps of the United States Geological Survey mounted for physiographic uses, the Harvard Geographical Models, a model of

New York Island to show the topography in 1776 as contrasted with the present, and a model of the Catskills, in which the vertical and horizontal scale being the same, the exact features were reproduced. In the department of physics a number of pieces of apparatus were exhibited from Columbia University, to show the latest advances in laboratory investigations and materials therefor. The stremmatograph, and records of results obtained on the Boston and Albany Railroad, exhibited by Mr. P. H. Dudley, attracted an unusual amount of interest. The last exhibit, at the end of the hall, was in electricity, and included a number of new pieces of apparatus from Columbia University and elsewhere, among which should be mentioned an induction coil with thirty-inch spark, and apparatus illustrating the Marconi system of transmitting signals to a distance without wire.

The amount of interest that has been awakened by the annual receptions and exhibitions in New York City is very large, and has increased greatly within the last year. We all feel that such an exhibit is a most helpful way in which to bring the knowledge of science before the people, and the appreciative interest of the visitors has proved an inspiration even to the most skeptical. The annual exhibition of the Academy has come to be looked upon as one of the scientific events of the year by the inhabitants of New York scientifically interested, and will undoubtedly be repeated each spring indefinitely.

Richard E. Dodge.

CURRENT NOTES ON BOTANY.

A NEW PLANT CATALOGUE.

Mr. A. A. Heller, of the University of Minnesota, has compiled what must prove to be a most useful catalogue of the higher plants (Pteridophytes and Spermatophytes) of North America north of Mexico. It is the first attempt at making such a catalogue under the 'Rochester and Madison Rules' and following the Eichler sequence of families, and for this reason is of more than ordinary interest. It is moreover the first catalogue of the plants of North America prepared by a working botanist.

There are 14,534 entries with a few duplicated numbers, which may increase the whole number by fifty or seventy-five more. Of this vast number more than 14,000 are flowering plants proper, there being 263 ferns and fern-allies and 112 gymnosperms. The largest families are Compositæ (exclusive of Cichoriaceæ, 146) with 2149 species; Papilionaceæ 1095, with 129 in the closely related Cæsalpiniaceæ and Mimosaceæ; Gramineæ, 938; Cyperaceæ, 724. The larger genera are *Carex* with 431 species; *Astragalus*, 252; *Eriogonum*, 184; *Aster*, 157; *Erigeron*, 137; *Solidago*, 114. We learn also that there are 15 North American palms, and 210 orchids.

BIBLIOGRAPHICAL DIFFICULTIES IN BOTANY.

Dr. E. L. Greene prints, in a recent number of the *Catholic University Bulletin*, a thoughtful discussion of some of the troubles which confront the systematic botanists. In it he makes some pertinent remarks upon the importance of nomenclatural accuracy in science: "There is, of course, no science without its nomenclature and terminology. And in botany nothing can be done, at least no results of research can be communicated, apart from the names of the plants or groups of plants which have been under investigation. Just as the correct and full and true name of any man is a kind of necessity of his existence as a member of society, so the name of the family, of the genus and of the species to which any tree or shrub or herb belongs is indispensable to a scientific, or, indeed, any kind of understanding and discussion of it."

* * "Botanical nomenclature means, or ought to mean, the same name for the same group of plants, for all botanists of whatever language or nation. This is agreed to by all. And it is in a general way as universally conceded that, under certain limitations, and with important exceptions, the scientific name of every plant species is determined by the principle of priority of publication."

Dr. Greene then states precisely three important and fundamental nomenclatural principles, as follows: "(1) The employment of Latin as the language of plant names; (2) priority of publication, and (3) the binary character of all species names as being made up of a genus name of one term and a species name of one term." A plant is, therefore, to bear the oldest published Latin generic name of one term, combined with its earliest published Latin specific name of one term. These rules, while plain and evidently just, involve many difficulties in their application. Thus it happens that it is often difficult to determine what are the limits of many of the Linnæan genera as given in the 'Species Plantarum' of 1753, on account of the fact that Linnæus often *compiled* without critical examination. In the course of his discussion Dr. Greene suggests the advisability of taking Tournefort's 'Institutiones' of 1700 as the starting point for the genera of plants.

In regard to specific names much confusion has arisen on account of the insufficiency of so many of the Linnæan descriptions, and this can be helped in many cases only by a careful study of the earlier botanical authors, Dodonæus, Ray, Bauhin, Clusius, Plukenet, Micheli, Dillenius, Haller, Le Vaillant and Gronovius. "Just as the master of Latin philology must have close acquaintance with each one of the ancient Latin authors, so should every botanical scholar who would perfectly understand Linnæus be somewhat philologically familiar with every one of those standard pre-Linnæan authors to whose descriptions of plants Linnæus refers us on every page of his."

CHARLES E. BESSEY.
THE UNIVERSITY OF NEBRASKA.

CURRENT NOTES ON PHYSIOGRAPHY.

GEOGRAPHY OF INDIAN TERRITORY.

A THESIS presented to the Department of Geology of Stanford University by N. F. Drake on 'A Geological Reconnaissance of the Coal Fields of the Indian Territory' (Proc. Am. Phil. Soc., XXXVI., 1897, 326-419, map) contains a number of geographical notes on a little known district. The Ouachita mountain system extends into the territory south of the Arkansas and Canadian rivers, repeating the features described in Arkansas by Griswold; sharp monoclinal ridges on close folded structures, and flat-topped mountains, often synclinal in structure, where the folds are more open; all with an east and west trend, and contributing to the western extension of Appalachian-like disturbance and topography, as explained by Branner (*Amer. Jour. Sci., November, 1897*). A plateau with broad uplands and narrow valleys enters from the Ozark region on the northeast as far as the Grand and Arkansas rivers; repeating the features described for Missouri by Marbut (SCIENCE, V., 20), the 'Boston mountains,' a plateau with ragged promontories and outliers presenting the strongest relief in this division. The Great Plains enter from the northwest into the angle between the Grand and Canadian rivers; an extended area of moderate relief, descending gently eastward, and here and there falling in terrace-like escarpments, 50 to 100 feet high, as the harder strata are passed; thus repeating features so well described by the University of Kansas Survey on the North (SCIENCE, V., 945).

SUBMERGED VALLEYS ON THE CALIFORNIA COAST.

A PRELIMINARY paper of 1886 is now followed by a more detailed account of the 'Submerged Valleys of the Coast of California, U. S. A., and of Lower California, Mexico,' by George Davidson (Proc. Cal. Acad. Sci., 3 Ser., Geol., I., 1897, 73–103). Along our Pacific coast the continent descends to depths of 2,000 to 2,700 fathoms within fifty miles from the shore line. There is generally a ten-mile platform sloping out to the 100-fathom contour, after which the descent is relatively sharp. The edge of this platform is broken by twenty-seven 'submerged valleys,' finely illustrated in nine plates where all soundings are shown, so that one may measure the accuracy of the interpolated contours and be convinced not only that the platform is sharply notched where the submerged valleys are drawn, but also that it is essentially continuous elsewhere. The notches are sometimes in line with rivers on the land, as at Monterey and Carmel, but others appear to be entirely independent of existing drainage, as King peak and San Pablo valleys, both of which have to be named after mountains opposite their heads. The curious story is told of a vessel that was lost on the rocky coast fronting King peak; she probably had run in along the axis of the submerged valley and, finding no bottom with the ordinary line, thought she was at a safe distance off shore.

The possibility that certain chasm-like valleys, such as that of Vincente, result from dislocations appears to be excluded by the evenness of the littoral platform on either side of the chasm, but the actual origin of the valleys can hardly be found until they are studied in connection with the structure, form and drainage of the neighboring and still visible land. It is well to guard against the implication that submerged valleys result from 'continental' movements, by remembering that the earth's crust may bend beneath the sea as well as upon the land and that the down-bending and consequent submergence of a coastal belt gives no more warrant of a truly 'continental' movement than does the occurrence of a local inland anticline.

WATER RESOURCES OF INDIANA AND OHIO.

UNDER the above title, F. Leverett, for a number of years engaged on the study of drift deposits in the Ohio Valley, contributes an account of local water supplies, with particular reference to the occurrence of ground water in drift and rock (18th Ann. Rep., U. S. G. S., Pt. IV., 421–559). The essay includes much that is pertinent to these notes, and particular reference should be made to three maps that give sketch contours, rock geology and glacial features of the two States concerned. The last of the three is the best presentation yet published of the marvellously complex drift deposits formed by the great ice lobe from the Erie trough. Nothing could more forcibly illustrate the importance of including some explanatory account of geographical features in the ordinary teaching of geography than the contrasts here brought forward between different areas, according as they have been glaciated or not, or as they are sheeted with the older loess-covered till, the more recent moraine-belted till, or the still younger lake silts. The control of preglacial topography by rock structure and the effect of this topography on the advance of the ice sheets are well exposed; the Bellefonte Devonian outlier, and the Scioto and Miami groups of lobate moraines on either side of it, being manifest illustrations. The hilly uplands or 'knobs' of southern Indiana, determined by outcrops of the lower Carboniferous series, seem to have exerted a similar control over the extent of the earlier ice advance; but

here the confirmatory evidence of moraines is wanting. Remembering that the 'absence of moraines' was one of the arguments against the glacial theory but a few decades ago, this map is very edifying.

THE URAL MOUNTAINS.

ONE of the first contributions to our scientific literature resulting from the International Geological Congress in Russia last summer is by Dr. Persifor Frazer on a 'Geological Section from Moscow to Siberia and Return' (Proc. Acad. Nat. Sci., Phila., 1897, 405–457), in which some interesting geographical features of the Ural mountains are set forth. Approaching this range from the west, there is nowhere presented a bold rugged landscape like that of the Alps or the Caucasus; a gradual ascent leads across the disturbed ancient rocks, generally striking north and south, to the divide; then a moderate descent leads to a lower and open plain, although the disturbance of the rocks continues in full force. Karpinsky is quoted as writing of this plain that, "although its geological structure corresponds with a very complex mountain region, the greater part of it presents an area so flat that the relief is less accidented than that of most of the plains of European Russia;" and the removal of the former mountains is ascribed by the Russian geologist to abrasion by a Tertiary sea, whose sediments stretch into Siberia. From the divide one may look westward and see the ridges separated by longitudinal strike valleys, whose outlet is through transverse gorges to the Russian plains; to the east, one looks across the old mountain plain toward the boundless, lake-dotted steppes of Siberia. Deep lakes, with ragged shores and many islands, as well as numerous swamps, abound on the old mountain plain; their drainage is eastward by streams that have cut gorges in their middle course and opened broad-floored valleys farther forward. In the absence of all evidence of glacial action, several hypotheses are offered to account for the lakes.

W. M. DAVIS.

NOTES ON INORGANIC CHEMISTRY.

IN the *Proceedings* of the Chemical Society (London) T. C. Porter has a note on the volatility of sulfur. When heated to 100° in a vacuum tube sulfur sublimes with some degree of rapidity, the sublimate consisting of very pale yellow drops, which remain unchanged for several days; at ordinary temperatures even in a good vacuum there is no perceptible sublimate, even in the course of a year. In commenting on the paper Professor Dewar said that if the vacua are cooled with liquid air or oxygen a visible distillation of sulfur takes place even at ordinary temperatures.

AT the meeting recorded in the above *Proceedings* Professor Bohnslav Brauner, of Prague, was present for the purpose of reading four papers on the chemistry of the rare earths. The first two papers were on thorium, describing his method of purification as ammonium thoroxalate, and atomic weight determinations leading to the figure 232.42; agreeing with the work of Krüss and Nilson (232.45), but lower than that of Cleve (234.5). The third paper was on the compound nature of cerium, in which the author holds that some unknown element, of lower atomic weight (perhaps about 110) and with no characteristic spark spectrum, is present in the cerium from cerite. The last paper on praseodymium and neodymium is chiefly a study of the compounds of praseodymium. From experiments to determine whether the higher oxid PrO_2 belongs to the type of PbO_2 or BaO_2 the author concludes that it is "an oxid of a new kind, belonging simultaneously to the ozonic oxids of the water type, and to the antozonic oxids of the hydrogen peroxid type; it is, in fact, the

missing link between these two hitherto entirely different types of peroxids, its active oxygen being at the same time both entirely ozonic and entirely antozonic." He believes both praseodymium and neodymium may be further split up and will give when pure for their highest oxids the formulæ Pr_2O_5 and Nd_2O_6; hence, he would arrange the eighth series of the periodic system as follows:

I.	II.	III.	IV.	V.	VI.
Cs	Ba	La	Ce	Pr	Nd
133	137.4	138.2	139.7	141	143.6

Some months ago a petition, signed by several hundred members of the Chemical Society (London), was presented to the Council, asking for an amendment to the By-Laws so that members could vote for the officers at the annual meeting by proxy or by mail. As the number of members who can be present at this meeting is not large, a comparatively small proportion of the total membership practically controls the offices. The Council declined to take any action owing to the fact that such a By-Law would conflict with the charter. An effort was then made to have the Council seek an amendment to the charter, which was declined. A petition was then presented to have the Council take action to obtain the views of the members by taking a mail vote on the question: "Are you in favor of the proposal that a supplemental charter should be applied for to the Privy Council so as to enable Fellows to vote at the annual election of the officers by post or proxy?" This also the Council declines to do. The desire of the petitioners is so manifestly just that it is hardly probable the matter will be allowed to rest at this point, but it is to be greatly hoped that the usefulness of the Society will not be impaired by dissensions.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

THE CHICAGO SECTION OF THE AMERICAN MATHEMATICAL SOCIETY.

The third regular semi-annual meeting of the Chicago Section of the American Mathematical Society was held at the University of Chicago, on Saturday, April 9, 1898, with the following program:

1. A triangle related to Nagel's triangle. Professor Robert J. Aley, Indiana University.

2. The ellipsograph of Proclus and its inverse (illustrated by models). Dr. E. M. Blake, Purdue University.

3. The structure of the hypo-abelian groups. Dr. L. E. Dickson, University of California.

4. I. Quaternion notes. II. Introduction to the theory of functions of a quaternion or a vector variable. Dr. Shunkichi Kimura, Sendai, Japan.

5. On the most general form of the inner potential consistent with the complete integration of the differential equations of motion of a free system of two bodies. Dr. Kurt Laves, the University of Chicago.

6. Concerning the case where a linear substitution group of finite order in n variables breaks up into groups in a lower number of variables. Associate Professor H. Maschke, the University of Chicago.

7. On the roots of a determinantal equation. Professor W. H. Metzler, Syracuse University.

8. A two-parameter class of solvable quintics in which the rational relations amongst the roots by threes are independent of the parameters (preliminary communication). Head Professor E. H. Moore, the University of Chicago.

9. Dual algebras. Professor James Byrnie Shaw, Illinois College.

At the opening of the afternoon session, in response to the invitation of the program committee, Professor Michelson, of the University Chicago, made a very interesting exhibition of the theory and of the workings of the new 'Harmonic Analyser' to the members of the Society.

PROPERTIES OF THE X-RAYS.

Professor Röntgen has made to the Berlin Academy of Sciences a third communication on the X-rays. A summary in the *Electrical World* states that if an opaque plate is placed between the tubes and the screen, covering the whole of the latter, some fluorescence will still be seen even when the plate is directly on the screen;

he showed that this is due to the fact that the air around the tube gives forth X-rays; if our eyes were sensitive to these rays, as they are to light, then such a tube would be like a light in a room filled with smoke. The brightness of a screen illuminated with rapidly intermittent rays depends on a number of properties which he enumerates. The X-rays from a platinum focus plate which are most active for showing images are those which leave the plate at the greatest angle, but not much greater than 80°; thick plates have a relatively larger transparency than thin ones, that is, the specific transparency of a body is greater the thicker the body; when two plates of different bodies are equally transparent they need not necessarily be so when similarly increased in thickness; the relative thickness of two equally transparent plates of different materials is dependent on the material and its thickness, through which the rays have passed before they reach those plates; the same body has different transparencies with different tubes, 'soft tubes' being those requiring a small potential and 'hard tubes' those requiring a high one; he states that all bodies are more transparent for rays from hard tubes than from soft ones, and in obtaining images this must therefore be considered; the quality of the rays from the same tube depends on: The way in which the interrupter works; the Deprez form acts more regularly, while the Foucault form utilizes the primary current better; on the spark length in series with the tube; on the insertion of a Tesla transformer; on the vacuum; on other processes in the tube which are not yet fully investigated. A spark gap in series acts like a Tesla transformer, both giving more intense rays which are less easily absorbed; the smallest pressure at which X-rays are produced is very likely below 0.0002 mm. of mercury. The hardening of a tube is not produced only by continuing the exhaustion; to soften a hard tube, air may be admitted; it may be warmed, or the current reversed, or very strong discharges sent through it, but the latter generally changes the character of the tube; good results were produced with a tube containing a piece of charcoal of linden wood. The composition of the rays from a platinum anode depends largely on the element in the current; the quality of the rays does not change with changes of the primary current, or at least very little, but the intensity is proportional to the strength of the primary current between certain limits. He draws the following conclusions: The radiation consists of a mixture of rays of different intensity and absorbability; the composition depends greatly on the time element in the current; the rays produced by the absorption of bodies are different for different bodies; as X-rays are produced by cathode rays, and as both have common properties, it is probable that both processes are of the same nature. If two screens are illuminated with two tubes of different hardness, the illumination being made equal, and if then replaced by photographic plates, the one illuminated by the harder tube will be blackened much less than the other; rays which produce equal fluorescence can be photographically quite different; the usual photographic plates are very transparent for X-rays; in a pile of ninety-six filaments exposed for five minutes the last one showed photographic action. That the eye is not entirely passive to X-rays is shown by an experiment; in looking at a slit in a metal screen with the closed eye covered with a black cloth and by moving the head, a very weakly illuminated slit will be noticed; this may be explained by assuming that fluorescence is produced on the retina.

'CHRISTIAN SCIENCE.'

PROFESSOR J. MARK BALDWIN has, in the press of the Appletons, a little book called 'The Story of the Mind' (Useful Story Series). He allows us to print, from the proofs, the following short passage, which may have some interest to our readers in view of certain recent discussions by committees of the Massachusetts and New York Legislatures:

"All mental diseases involve disease of the brain, and can be cured only as the brain is cured. It does not follow, of course, that in some cases treatment by mental agencies, such as suggestion, the arousing of expectation, faith, etc., may not be more helpful here than in troubles which do not involve the mind, provided these agencies be wisely employed; but yet the-

end to be attained is a physical as well as a mental cure, and the means, in the present state of knowledge, at any rate, are mainly physical means. The psychologist knows practically nothing about the laws which govern the influence of mind on body. The principle of suggestion is so obscure in its concrete working that the most practiced and best-informed operators find it impossible to control its use or to predict its results. To give countenance, in this state of things, to any pretended system or practice of mind-cure, Christian science, spiritual healing, etc., which leads to the neglect of ordinary medical treatment, is to discredit the legitimate practice of medicine and to let loose an enemy dangerous to the public health.

"Moreover, such things produce a form of hysterical subjectivism which destroys sound judgment and dissolves the sense of reality which it has taken modern science many generations to build up. Science has all along had to combat such wresting of its more obscure and unexplained facts into alliance with the ends of practical quackery, fraud and superstition; and psychologists need just now to be especially alive to their duty of combating the forms of this alliance which arise when the new results of psychology are so used, whether it be to supplement the inadequate evidence of 'thought transference,' to support the claims of spiritualism, or to justify, in the name of 'personal liberty,' the substitution of a 'healer' for the trained physician. The parent who allows his child to die under the care of a 'Christian science healer,' is as much a criminal from neglect as the one who, going but of step further in precisely the same direction, brings his child to starvation on a diet of faith. In France and Russia experimenting in hypnotism on well persons has been restricted by law to licensed experts; what, compared with that, shall we think of this wholly amateurish experimenting with the diseased? Let the 'healer' heal all he can, but don't let him experiment, to the extremity of life and death, with the credulity and superstition of the people who think one 'doctor' is as good as another."

GENERAL.

At a stated meeting of the Board of Overseers of Harvard College on April 13th it was voted to concur with the President and Fellows in their votes appointing Alexander Agassiz, LL.D., Director of the Museum of Comparative Zoology, as professor emeritus.

Major Jirard and Medical Director Tryon have been in attendance at the Congress of Hygiene, Madrid, as delegates from the medical departments of the army and navy of the United States.

The Council of the Linnæan Society, London, has decided to award the Society's gold medal this year to G. C. Wollich, in recognition of his investigation of the biological conditions of the deep sea.

We regret to record the death, on April 17th, of Dr. Jules Marcou, the geologist and a writer on a wide range of scientific subjects. Dr. Marcou was born in Salins, France, seventy-five years ago.

Sir William Turner, F. R. S, professor of anatomy at Edinburgh, has been elected a corresponding member of the Berlin Academy of Sciences.

Sir Samuel Wilkes has been re-elected President of the Royal College of Physicians, London.

The French Minister of Public Instruction has announced that the prize of the value of $1,000, founded by M. Angrand for a work on American archæology, has been awarded to Dr. Hamy for a study of The Gallery of American Antiquities in the Museum of Trocadéro.

The Municipal Council of Paris has authorized the erection of the monument to Charcot by Falguière on the Place de l'hospice de la Salpêtrière.

M. Felix Faure, President of the French Republic, has consented to preside at the first session of the International Medical Congress to be held in Paris in 1900.

Professor Frederick Starr, of the University of Chicago, has lately returned from a trip to Mexico, in which he began a study of the physical types of the southern Mexicans. Four tribes were visited—Otomi, Tarascan, Tlaxcalan, Aztec. Careful descriptive notes, measurements and photographs were made. One hundred men and twenty-five women, in each tribe, were examined. A series of fourteen

plaster busts was made. Collections of dress, implements and weapons were secured. The work will be continued next winter among the tribes of Oaxaca and Chiapas, the southernmost States of the Republic. The results so far gained will probably be presented at the next meeting of the A. A. A. S. A somewhat careful examination was also made of the ruins of La Quemada, in the State of Zacatecas. The curious and ancient picture record of the Conquest preserved at Cuablhtlautzineo was photographed and will soon be published. A large collection of objects illustrating the folk-lore of the half-breed Mexicans was secured; this is to belong to the English Folk-Lore Society. The catalogue of this collection, with descriptive notes, is to be printed as one of the Society's regular publications. Lastly, some investigation was made of hexdactyly and other abnormal conditions, some interesting molds and data being gathered.

PROFESSOR LAWRENCE BRUNER, of the University of Nebraska, returned, on April 6th, from the Argentine Republic, where he had been engaged for year in studying the habits of a devastating locust. His report is now in press and is expected to appear soon.

THE Royal Society will hold its first Conversazione this year on Wednesday, May 11th.

A 'JARDIN DE KEW' is to be established in the neighborhood of Nantes by a rich citizen of that town. The new botanical garden will be planned on the same lines as the Royal Gardens at Kew, and special attention will be given to the cultivation of plants useful in French colonies. It is hoped that the garden will eventually do for French colonial possessions what Kew does for British colonies.

A COURSE of ten popular lectures on Amphibians and Reptiles will be delivered in the lecture room in the Zoological Society of London Gardens, Regent's Park, on Thursdays, at 5 p. m., commencing April 21st, by Mr. F. E. Beddard, M.A., F.R.S., Prosector to the Society.

A SECTION of ornithology has been formed in the California Academy of Sciences, with Mr. L. M. Loomis as President.

THE late Mr. G. C. Dennis has bequeathed his entomological collection to the Yorkshire Philosophical Society.

THE United States Civil Service Commission calls attention to the examination which will be held on May 6, 1898, at any place where the Commission has a competent board of examiners, for establishing a register from which the position of Chief of Division of Library and Archives, United States Coast and Geodetic Survey, Treasury Department, at a salary of $1,800 per annum, may be filled. This is a very important and responsible position, and the Commission is anxious that the competition shall be as extensive as possible. On April 25th an examination will be held for a teacher of manual training in the Indian service, with a salary of $720.

THE executors of the late Baron Ferdinand von Müller, Government Botanist of Victoria, are collecting money to erect a monument over his grave in the St. Kildare Cemetery at Melbourne. Over one hundred subscriptions have already been received, including donations from the London Royal Geographical Society and other scientific associations. We do not notice in the list any subscriptions from America, and it is to be hoped that these will be supplied before the subscription is closed. Letters should be addressed to Rev. W. Potter, 'Vonmueller,' Arnold street, South Yarra, Melbourne, Australia.

WE are also informed that Baron von Müller's supplemental volume on the *Flora Australiensis*, upon which he had worked for years and was preparing for the press at the time of his death, together with two volumes on his administration as Director of the Botanical Gardens, embracing a biography and complete bibliography of his writings, are to be published. His executors will feel favored by the loan of any of his letters, or the communication of incidents in the Baron's life which his friends deem to be worthy of notice in his biography. Communications on this subject should also be addressed to the Rev. W. Potter.

To commemorate the dedication of the new laboratory of chemistry of the University at Leipzig, its Director, Professor Ostwald, has collected the researches carried out in the old

laboratory by him and his students during the ten years from 1886 to 1896. The four large volumes resulting are published by Herr Engelmann, Leipzig.

The long-looked-for first volume of the 'Phytogeography of Nebraska,' by Messrs. Pound and Clements, was received from the printer by the authorities of the University of Nebraska on the 7th of the current month.

The April number of *The Auk* contains the programs of the annual meetings of the Delaware Valley Ornithological Club and of the United Ornithologists of Maine. The former Club met at the Academy of Natural Sciences in Philadelphia, with 34 members in attendance. Mr. I. Norris DeHaven and Mr. Charles J. Rhodes, Secretary. The United Ornithologists of Maine held their second annual meeting in the rooms of the Portland Society of Natural History on December 31st and January 1st. Mr. Ora W. Knight was elected President and Mr. L. W. Robbins Secretary. The *Maine Sportsman* is the official organ of the Society and publishes full accounts of the the meetings and many of the papers.

The following bill, introduced by Senator George F. Hoar, has already passed the United States Senate, though it is rumored that certain importers and milliners have held a meeting in New York, and propose to send a powerful lobby to Washington to defeat the bill in the House. There is, however, some probability that the bill will pass the House if humane persons and those interested in the protection of our native animals will immediately call the matter to the attention of their Representatives.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the importation into the United States of birds, feathers, or parts of birds for ornamental purposes, be, and the same is hereby prohibited; Provided, however, That nothing herein contained shall be construed as prohibiting the importation of birds for museums, zoological gardens, or scientific collections, or the importation of living birds or of feathers taken from living birds without injury to the bird. The Secretary of the Treasury is hereby authorized to make regulations for carrying into effect the provisions of this section.

"Sec. 2. That the transportation of birds, feathers, or parts of birds, to be used or sold, from any State or Territory of the United States to or through any other State or Territory of the United States, is hereby prohibited. Whoever shall violate the provisions of this section shall, upon conviction in the district where the offense shall have been committed, be punished for each such offense by a fine of fifty dollars.

"Sec. 3. That the sale, keeping, or offering for sale, within any Territory of the United States, or within the District of Columbia, of birds, feathers, or parts of birds, for ornamental purposes, except such as are excepted in the first section of the Act, be, and the same is hereby prohibited. Whoever shall violate the provisions of this section shall, upon conviction, be punished for each such offense by a fine of fifty dollars."

The Massachusetts Audubon Society held a meeting in Association Hall, Boston, on April 14th, to protest against the slaughter of birds for millinery purposes. Professor C. S. Minot presided and made an address, which was followed by addresses by Mrs. Alice Freeman Palmer and by Mr. Frank M. Chapman, of the American Museum of Natural History, New York.

Arrangements for the excursions of the Appalachian Mountain Club of Boston for the present year are not yet completed, but there is a strong probability that the following program will be carried out: May 27th–June 1st, Hoosac Tunnel Station. The intention is to visit Greylock, and Haystack in Wilmington, Vt. June 16th–19th, Warwick and Mt. Grace. June 17th, harbor excursion. July 1st–11th, the Field Meeting will, in all probability, be held in the Adirondacks. August, there will be a camping party at a lake. September 2d–6th, Camden, Me., and its mountains will be visited. October, Dixville Notch (a week or ten days).

Captain Jacques read, on March 31st, an interesting paper before the British Institution of Naval Architects on 'Submarine Torpedo Boats,' in which he criticised the contemporary form of torpedo boat, asserting its unreliability and general flimsiness, and gave as his opinion that it is often more dangerous to its own crew than to the enemy. He considers the submarine torpedo boat the coming

form of this most modern of naval weapons and points to its complete invisibility in action, its power of carrying armor if desired, its perfect liberty of movement under water and safety and certainty in placing its torpedo, as well as the comfort and safety of its own crew, as considerations that must inevitably ultimately give it the leading place in a naval establishment, and especially for one like that of the United States, planned mainly for defense.

THE commercial reporters of *Industries and Iron* state that Messrs. L. Lowe & Co., of Berlin, Germany, manufacturers of electric supplies, have ordered from the United States an Allis-engine of 900 h. p. to furnish light and power at their works. The Société des Railways économiques de Liége, Seraing et Extensions, and the Compagnie générale des Railways à Voie étroite, have sent to the United States for a complete electrical equipment of the Westinghouse Company's make. A large business has been secured by builders of heavy machinery in the United States, for delivery in Great Britain, and it now seems probable that they may find a profitable and an extensive market on the Continent of Europe. The manufacturers of Europe are, however, reported to have good business, and competition from this side of the ocean has not produced any sensible effect in the direction of transfer of trade to this country.

IT will be remembered that the Paris International Meteorological Conference of 1896 appointed a permanent Committee on Terrestrial Magnetism and Atmospheric Electricity, and submitted to it a number of questions for report. In order that these questions may be well discussed, says *Nature*, it has been decided to hold an international conference on terrestrial magnetism and atmospheric electricity in connection with the forthcoming meeting of the British Association at Bristol, which will begin on September 7th. Letters of invitation are being sent out by the Committee; and all foreigners who propose to attend the conference may obtain tickets of membership of the British Association, free of charge, on application to the Assistant General Secretary of the Association. Among the subjects to be discussed are: The calculation of monthly means with and without taking disturbed days into account; the publication of the monthly means of the components X, Y, Z, and the differences ΔX, ΔY, ΔZ, of the monthly means from the preceding means; the establishment of temporary observatories, especially in tropical countries; and the relative advantages of long and short magnets. The decisions of the conference upon these questions will be reported direct to the International Meteorological Conference. But though the first business of the conference will be to report upon the questions submitted to them, papers and communications on other subjects connected with terrestrial magnetism and atmospheric electricity are also invited. It is desired that such papers be sent to the Committee some time before the opening of the British Association meeting

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UNIVERSITY AND EDUCATIONAL NEWS.

AT a meeting of the Board of Trustees of Cornell University on April 14th it was decided to establish a medical department to be located in New York City. The faculty will consist chiefly of the members of the faculty of the New York University Medical College who have been dissatisfied with the relations between the College and the University. The new medical college, like other departments of Cornell University, will be open to women on the same terms as to men, and students appointed to State scholarships by the Superintendent of Public Instruction may obtain free tuition from Cornell University in medicine hereafter, as they now obtain it in art, law, engineering, architecture, etc. It appears that Colonel Oliver H. Payne has given $500,000 toward an endowment and that buildings will be erected at once. The College will be opened next year with Dr. W. M. Polk as Director.

AT the same meeting Dr. B. E. Fernow, Chief of the Division of Forestry, United States Department of Agriculture, was elected Director of the College of Forestry, recently established by an appropriation from the Legislature of the State of New York.

PROFESSOR EARL BARNES, lately professor of education in Stanford University, will, it is

said, on his return from Europe, occupy a chair in the newly-established School of Pedagogy in Cornell University, devoting himself chiefly to problems of child-study.

At the meeting of the Board of Regents of the University of California on April 12th Mrs. Phœbe Hearst offered to construct and equip at her expense a building for the College of Mines.

McGill University has suffered severe losses in the resignation of Professor Hugh L. Callendar, of the chair of physics, and Professor C. A. Carus-Wilson, of the chair of electrical engineering. Professor Callendar has been appointed to the chair of physics in University College, London, vacated by the resignation of Professor Carey Foster.

The summer session of the University of Nebraska opens on June 6th and closes July 16th. It is to take the place of the University Summer School, hitherto maintained for from two to four weeks each year. Regular University work will be offered in eighteen departments and special work in six or seven more. It is the expectation of the University authorities ultimately to develop the summer session so as to afford opportunities for vacation work along nearly all lines of University study. The sciences now offered are botany, chemistry, entomology, geology, physics and zoology.

DISCUSSION AND CORRESPONDENCE.

ISOLATION AND SELECTION.

To the Editor of Science: Will you permit me to use your pages for protesting against the indiscriminate use of the word 'Selection' by writers on Organic Evolution. Selection means the act of picking out certain objects from a number of others, and it implies that these objects are chosen for some reason or other. Now Selection, by itself, can never originate a new variety or a new species. To do this it must always act in conjunction with the isolation of the selected individuals.

'Artificial Selection,' by which breeders form new races of domesticated animals, consists of two distinct processes. The breeder first selects his animals and then isolates them from those which have not been selected. It is isolation of the individuals which produces the new race; selection merely determines the direction the new race is to take. On the other hand, Isolation is capable of originating new species without the cooperation of Selection. For, if a few individuals of a species become isolated from the others by some physical agency, such as a flood, a drought or a hurricane, and happen to have some peculiarity or variation different from the average of the species, that variation will now have a special chance of being propagated and probably intensified, although the original parents were not selected in any way. The one factor common to all cases of organic evolution is Isolation, and consequently it must be considered as the most important factor.

I have summarized the different ways in which Isolation can be brought about in a paper in *Natural Science* for October, 1897, to which I may be allowed to refer any of your readers who are interested in the matter. Selection implies the action of a Selector outside of the individuals which are selected, whether that Selector be, or be not, conscious of what he is doing; this is the Artificial Selection of Darwin. Natural Selection is not truly selection, for the individuals can hardly be said to select themselves by their superior strength, cunning, or what not. Still the term has become so firmly established that it can well be allowed to pass, if used only in Darwin's sense of advantage gained in the struggle for existence, either by the individual or by the species. It is, certainly, quite as good a term as Organic Selection, and has the advantage of having been proposed by the founder of the doctrine of evolution.

I quite agree with Professor Mark Baldwin and others that Determinate Evolution is the only explanation of the main facts of organic progress. But alongside of this Determinate Evolution a large amount of Indeterminate Evolution has also been going on. For example, although Humming Birds and Diatoms, as groups, are the product of Determinate Evolution, I cannot believe that all the specific characters of the various Humming Birds, or the specific and generic characters of the various Diatoms, are due to the same agency, for they show no definite tendency in any direction, but merely variety.

Now, while we think of all evolution as the result of some kind or other of Selection this remains an enigma. But when we distinguish between the two processes of Isolation and Selection and assign to each its true function we get at once the explanation of our difficulty. Determinate Evolution is due to the combined action of Isolation and Selection. Indeterminate Evolution is due to the action of Isolation alone.

I think that Darwin had this distinction in his mind when he said that Natural Selection was the chief, but not the only, cause of the origin of species. At any rate, it seems to me to embody the whole truth, although Darwin's attention was chiefly devoted to establishing the cause of Determinate Evolution by, what I hope we may still call, Natural Selection.

F. W. HUTTON.

CHRISTCHURCH, NEW ZEALAND, March 1, 1898.

MODERN STRATIGRAPHICAL NOMENCLATURE.

ONE of the most noteworthy features connected with every one of the various branches of the rapidly expanding science of modern geology is a widespread and oft-deplored change in terminology. Old names are discarded, the meanings of others are altered, and a host of apparently useless new ones are proposed.

In no department has the coining of new names gone on more vigorously than in stratigraphical geology. The reason is to be found partly in the naturally favorable conditions that prevail in the field, but largely in the change of base that this branch of science has undergone in late years.

The fundamental conception of the geological formation, whether large or small, whether a great series or a single bed, is a sharply defined 'geological unit' instead of a vaguely bounded 'group' of layers. The former is now clearly distinguished by strictly physical characters that are inherently the direct outgrowth of the actual conditions giving rise to the formations. The latter have been too often based upon trivial or accidental features that are relatively unimportant as critical criteria, either in correlation or classification.

The principle underlying the recent change in the method of naming geological formations gives to each stratigraphical unit a special geographical designation taken from some prominent town, watercourse, or feature of relief, within the boundaries of the formation and where the latter is typically or unusually well shown. As thus established, the formation is a well-defined and independent unit, having a definite position in space, and always an exact relative place in the geological scale, no matter how the latter may be changed afterwards or what method of classification is followed. This definite stratigraphical unit contrasts strangely with the unwieldy, ill-defined and usually little understood large 'group' of the past, the very name of which commonly indicated either a lack of exact knowledge of itself, or a covering-up of almost total ignorance regarding its real affinities.

To be sure, the nomenclature in the field of geology has been greatly increased, even enormously enlarged, by the introduction of the plan. The former list of names numbered only two or three score or so—names of the smallest subdivisions that went to make up the general geological column. The names of the new list run up into the hundreds or even thousands, are different in every region, and additions are constantly being received.

Against this copious multiplication of geological names protests long and loud have gone up these several years past. Still, from time to time, the protestations continue to be uttered. Curiously enough, the struggle, if such it might be called, has been largely reduced to a clash between the practical field geologists on the one hand and on the other the laboratory workers, those especially interested in some particular and limited phase of geology, and the paleontologists who see, in the new scheme, their standard classification scattered to the four corners of the earth and their usefulness in the domains of geology diminished. And the former have manifestly won.

When, a decade and a-half ago, various geological surveys in this country were established or reorganized those intrusted with the work soon found that if speedy and exact results were to be secured—substantial data upon which all other workers could easily build—

something else must be devised than the existing cumbersome and unsatisfactory scheme of vaguely defined geological formations, having no comparable limits in the different geological provinces and even diverse values in the same province, some plan that must be natural and at the same time elastic. Practical experience in the field and the demands of the times soon pointed out a feasible scheme. So well has it served the purpose, and so readily adaptable is it to the changing conditions met with on all sides and to all the unforeseen exigencies continually arising, that it has brought under its standard nearly every practical field geologist.

The present method of designating geological formations by geographical names certainly does greatly expand the nomenclature at times seemingly to a burdensome extent. This appears to be the only objection that has been urged against the plan that might call for notice. Yet, to all except those who do not wish to go beyond the ordinary text-book in geological work, even this seems hardly worthy of special argument, since it is offset by so many manifest advantages.

It may be truly said that no greater boon to the working, as well as to the theoretical, geologist has been devised. Incorporated in the new plan are practically all of the salient good features of the old method, while none of the many objectionable ones are retained. Since its adoption a vast mass of exact information has been obtained that was previously unthought of—information that is in shape to be always used, without the necessity of going all over the ground again; the other departments of geology have been greatly aided, and stratigraphical geology itself has been capable of making greater real progress in the one short decade that has elapsed since the method came into use than in all time previous. In the same short period more has been learned about the real nature of sedimentation, the actual relations existing between different rock formations and the structure of the layered cuticle of the globe, than was possible before. In fact, a rational basis for geological correlation and a genetic classification of formations has been found.

The real meaning, then, of the multitude of new titles that has recently made its appearance in the literature of stratigraphy is the practical adoption of more refined methods of geological work, the provision of means for the collection of more exact geological data and the grasping of more rational conceptions regarding geological correlation and classification.

Charles R. Keyes.

SCIENTIFIC LITERATURE.

Die Farnkräuter der Erde. By H. Christ. Jena, Gustav Fischer. 1897. Mit 291 Abbildungen. 8vo. Pp. 388. 12 M.

In the preparation of such a work as the above one is expected either to have in mind the filling of a felt want, or at least to furnish a sufficient reason for the expenditure of so much energy. Neither of these seems to have been considered in the present case, if we judge of the work by the test of completeness which the title would lead us to expect. The purpose of the work seems to be the presentation of the general systematic relations of the genera and characteristic species of ferns, without attempting completeness either in the flora of a given region or the full quota of species of any particular group. As a manual for the identification of species its value can only be slight, as it is most likely to be deficient at the point where it is most needed, for usually there is no suggestion whatever of the nature, distribution or number of the allied species, and the specific descriptions that are given are not uniformly full, many of them being very incomplete. The work will be useful within narrow limits, however, particularly among florists and those to whom scientific accuracy is not so uniformly important. It describes more or less completely 1154 species of ferns, which, at a moderate estimate, cannot much exceed one-third of the known species of the world.

The system of classification is not strikingly novel, following in the main that of Mettenius and Prantl. While the number of recognized genera (99) is considerably larger than that recognized at Kew, which has been followed in this country, it will by no means satisfy those who regard genera, among ferns as elsewhere, as natural groups of organisms closely connected in habit and other biological characters, instead of artificial groups thrown together for conven-

ience according to the presence or absence of some unimportant structure. Presl, who was one of the first to recognize natural divisions among the ferns, gave us 230 genera; John Smith, with the advantage of the Kew collection and the largest number of species anywhere in cultivation, only reduced this number to 220; while Fee, the illustrious French pteridologist, recognized 181, and Moore a little later 177. The Kew authorities recognize only 78 including recent additions.

The system followed in the present work can be best judged perhaps by the following outline of its main features:

LEPTOSPORANGIATÆ.

(*Polyangia.*)

Hymenophyllaceæ.
Polypodiaceæ.
  Acrosticheæ.
  Vittarieæ.
  Gymnogrammeæ.
  Polypodieæ.
  Pterideæ.
  Aspleniaceæ (*sic*).
  Aspidiaceæ (*sic*).
  Davalliaceæ (*sic*).
Cyatheaceæ.
Osmundaceæ.

(*Oligangia.*)

Matoniaceæ.
Gleicheniaceæ.

(*Monangia.*)

Schizæaceæ.
Parkeriaceæ.

EUSPORANGIATÆ.

Marattiaceæ.
Ophioglossaceæ.

Concerning the arrangement of families there would probably be little difference of opinion except that from an evolutionary standpoint the order should be inverted and the position of the Hymenophyllaceæ would be called in question. The tribes of the Polypodiaceæ will permit more diversity of opinion. Among the good points to be noted are the removal of *Notholæna* (wrongly printed *Nothochlæna*) to the Pterideæ, where it stands next to its close ally, *Cheilanthes;* the removal of *Lindsaya, Nephrolepis* and *Loxsoma*, to the Davallieæ; also the formation of distinct families for the aberrant *Matonia* and *Ceratopteris*. The separation of the unique *Platycerium* from the Acrosticheæ is well timed, but it finds a resting place just as unsatisfactory next to *Polypodium* and always will be a migrant until it is placed in a distinct family of which it is worthy on account of its unique characters.

The divisions of genera are interesting, but exceedingly unequal. *Acrostichum* as recognized by Baker here appears under seven or eight genera, but the equally composite *Gymnogramme* is grouped under only three generic names, though some of its species are relegated to *Polypodium* and *Phegopteris*. *Hemidictyon, Ceterach, Diplazium* and *Athyrium* (the latter including *A. filix-fœmina*) are separated from *Asplenium*, while the equally distinct *Thamnopteris* (*A. nidus*) and *Darea* are still left in the genus, and the more distinct *Camptosorus* and *Schaffneria* are still left in the same genus as *Scolopendrium*. *Struthiopteris* is very properly separated from *Onoclea*, and *Cibotium* and *Dennstedtia* from *Dicksonia*, though in each case there are complications of nomenclature that will demand a later settlement. Both *Polystichum* and *Nephrodium* are united under *Aspidium* and *Fadyenia* is also included, contrary even to the conservative Kew practice. We are still very far from a natural segregation of the genera of ferns.

The recognition of species, especially those of American origin, is exceedingly faulty. The combination of *Notholæna candida, N. Hookeri* and *N. cretacea* into one species is no less notorious than the reduction of *Aspidium Goldieanum* and *A. marginale* to varieties of *A. filix-Hymas.* Quite a number of our American species appear under new names, which will be a new source of grief to conservative botanists, who are troubled because names will change with the advance of investigation. Among these not already mentioned we note:

Chrysodium aureum instead of *Acrostichum aureum.*

Neurodium lanceolatum instead of *Tænitis lanceolata.*

Blechnum spicant instead of *Lomaria spicant.*

Dennstedtia punctiloba instead of *Dicksonia punctiloba.*

The work is illustrated by 291 cuts, which, if not elegant, are mostly sufficiently accurate, and characteristic of the species indicated, to be of value; many of them are original. Two or three new species appear in the work for the first time.

LUCIEN M. UNDERWOOD.

The Calorific Power of Fuels. By HERMAN POOLE, F.C.S., etc. New York, J. Wiley & Sons; London, Chapman & Hall. 1898. 8vo. Pp. xv + 255.

The importance of a work on this subject is to-day vastly more evident, and is very much greater than before the days of scientific discussion, investigation and experimental researches in connection with the processes of modern engineering in the department of heat production and utilization. The extensive application of scientific methods by the engineer in his steam engine and boiler trials, and in a thousand other lines of professional work, also makes the subject and such compilation of facts and data peculiarly important. A work specially devoted to this subject thus assumes rare value.

This treatise is based upon M. Scheurer-Kestner's *Pouvoir calorifique des combustibles* and has been worked into a shape which adapts it to our own data and methods and includes later developments both of method and of apparatus. It gives us an excellent general discussion of the calorimetric principles and of the calorimetric apparatus now available for use by the chemist and by the engineer, and, with especial fullness, all of those found helpful in commercial work.

The fuels are described at considerable length and their heating powers given as computed from their composition and checked by direct calorimetric measurement. The report of the committee of the American Society of Mechanical Engineers on exact methods of steam boiler trial is introduced, and a large quantity of data and an excellent bibliography are appended, the latter including numerous and helpful references to the files of scientific journals. The 'Fuel Table,' in which are given the composition and the calorific power of the fuels of the world, is the most extensive yet produced and is extremely interesting and valuable.

The book is well up to date and includes descriptions of the latest calorimeters, as Berthelot's, Mahler's Barrus' and Carpenter's, gives Ringelmann's 'smoke scale,' Kent's revision of 'Johnson's Report on Coals,' and other no less important recent contributions to the literature of the subject.

The book is one which is likely to find its way into the library of all chemists and of all engineers having to do with applications of the calorific power of fuels. It is well written, well published and of moderate cost.

R. H. THURSTON.

SCIENTIFIC JOURNALS.

The Journal of Physical Chemistry. The January number begins the second volume of this journal. The opening article is the first part of an extensive paper 'On the General Problem of Chemical Statics:' by P. DUHEM, Professor of Theoretical Physics at Bordeaux. The paper is "a commentary on and a complement to the celebrated memoir of J. Willard Gibbs, 'On the Equilibrium of Heterogeneous Substances.'" The second article, 'Fractional Crystallization:' by C. A. SOCH, is a contribution to the theory of separations by fractional crystallization. 'Distribution of Mercuric Chlorid between Toluene and Water:' by OLIVER W. BROWN, completes the original matter. Several pages are devoted to book reviews. The department of reviews of the journal literature of physical chemistry is very full and critical.

February. 'Solutions of Silicates of the Alkalies:' by LOUIS KAHLENBERG and AZARIAH T. LINCOLN. From freezing point and conductivity determinations of solutions of the silicates of sodium, potassium, lithium, rubidium and cesium, it is concluded that in such solutions the silicate is hydrolytically decomposed into the caustic alkali and colloidial silicic acid. 'On the General Problem of Chemical Statics:' by F. DUHEM. The conclusion of the paper begun in the January number. 'On Integrating Factors:' by P. SAUREL. A mathematical introduction to theoretical studies that are to follow. 'Vapor-tension of Concentrated Hydrochloric Acid Solutions:' by F. R. ALLAN. It is concluded that electrolytic dissociation is not an

adequate explanation of the fact that hydrochloric acid solutions do not obey Henry's law. Book and journal reviews.

March. 'The Equilibria of Stereoisomers:' by WILDER D. BANCROFT. A study of substances having variable melting points. 'Acetaldoxime:' by HECTOR R. CARVETH. A study of its variable melting points. 'Naphthalene and Aqueous Acetone:' by HAMILTON P. CADY. 'Indicators:' by JOHN WADDELL. The effect of organic solvents in discharging the colors of indicators. 'Normal Elements:' by D. MCINTOSH. Book and journal reviews.

Mention should be made of the excellent style and typography of the *Journal*.

THE articles in the current number of *The American Naturalist* commemorate the fiftieth anniversary of the beginning of Agassiz's instruction in Harvard University, marking, as is said in an editorial article, an era in the history of zoology in America. An unsigned article reviews the life of Agassiz, with special reference to his activity as a teacher. Then follow articles on The Philosophical Views of Agassiz, by Professor A. S. Packard; Agassiz and the Ice Age, by Professor G. Frederick Wright; Agassiz on Recent Fishes, by President David Starr Jordan; Agassiz's Work on Fossil Fishes, by Professor Charles R. Eastman; Agassiz's Work on the Embryology of the Turtle, by Mrs. Gertrude C. Davenport, and Agassiz at Penikese, by Professor Burt. G. Wilder.

SOCIETIES AND ACADEMIES.

BOSTON SOCIETY OF NATURAL HISTORY.

AT the general meeting, February 2d, sixty-four persons were present.

Mr. William C. Bates showed a series of lantern views illustrating the natural features of Jamaica and the Jamaicans. He gave a brief historical account of the island and spoke of the advantages due to its accessibility and climate and to many of the interesting characteristics judged from a natural history standpoint. Mr. Bates closed with a series of proverbs and riddles showing that the legends and beliefs of the Jamaicans have many similarities to those of other countries.

A general meeting was held February 16th, with twenty-four persons present.

Mr. John Murdoch read a paper on the animals known to the Eskimos of northwestern Alaska. The climate and natural features of the country near Point Barrow were briefly described, and the behavior of the ice noted. In the capture of animals the bow has been superseded by the rifle. The Eskimos depend upon the walrus, the seals and the whales; the ring seal (*Phoca fœtida*) is the most important animal, the reindeer being next in importance. The polar bears are not common and avoid encounters with men and dogs. The wolf is not found in the vicinity of Point Barrow, but is abundant in the reindeer country; they chase the deer in packs. The tail of the wolverine is especially valued for decorative purposes. The Arctic fox is the most abundant animal found at Point Barrow; it is very shy and so well protected that it is seldom seen. The habits of many birds, the various eiders and gulls, the snow bunting, Lapland longspur, snowy owl and ptarmigan were noted. The Eskimos do not pay much attention to birds.

The Society met March 2d, seventy-one persons present.

Mr. Hollis Webster spoke of some common mushrooms, edible and poisonous, describing in detail the principal characteristics of the common mushroom, *Agaricus campestris*, and of the deadliest member of the group, *Amanita phalloides*. Mr. Webster mentioned the popular interest in the group, its value as food, and noted briefly the classification and method of growth of the fungi. He also described, with the aid of a series of lantern slides, many forms of *Boleti*, *Russula*, *Lepiota*, etc.

At the general meeting held March 16th there were one hundred and fifty-two persons present.

Professor William Libbey read a paper on Cuba, which was illustrated by lantern slides. Professor Libbey's account was based upon personal observation and gave a brief sketch of the country, with special reference to the physical features and to the customs and characteristics of the Cubans.

SAMUEL HENSHAW,
Secretary.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO—FEBRUARY AND MARCH, 1898.

THE PRONEPHROS IN TESTUDINATA.

WIEDERSHEIM, in his paper, 'Über die Entwicklung des Urogenital apparates bei Crocodilen und Schildkröten,' 1890, states that he has been entirely unable to distinguish between pronephros and mesonephros. A study of the earlier development explains his position.

From some very young embryos of Aromochelys and Platypeltis it has been possible to determine the origin and extent of the pronephros. It arises as segmental outgrowths from the posterior somatic region of the somites and is very marked, bridging over the fissure from one somite to the next. The tips overlap and fuse with the following outgrowth. In a very young series the fusion is so complete that a prominent and quite even ridge or welt is formed, extending from the sixth to the tenth somite. Stretching from the end of the pronephros we find the pronephric duct at first close to the somites, further back free, and at its tip at least in some cases fused with the ectoderm. Mitsukuri says he has proved this fusion beyond the possibility of a doubt.

As we proceed to the later stages, however, a new factor comes in which greatly modifies these conditions. Before there is more than a hint of the lumen in the pronephric tubules; we see in some of the same somites (from the second pronephric tubule, on) as well as further back, at the point where they pass in the middle plate, a thickening and occasionally a small bubble-like lumen. These aré the Anlagen of the mesonephric tubules. They become more and more distinct. In some series we find the funnel of the pronephric tubule and that of this mesonephric rudiment, opening side by side into the body cavity, but further posterior, and in older embryos we find the pronephric funnels opening into these rudiments of the mesonephros and through them into the body cavity.

There is no break between the pronephros and mesonephros. The first purely mesonephric tubule is in the next somite to the last one which shows the fusion of pronephric and mesonephric elements. Thus it becomes clear that although the pronephros is distinct in origin, it arises as segmental outgrowths from the somites and extends over but few segments; the mesonephros arising from the middle plate extends almost as far anterior as the pronephros, and the two are so fused in the later stages that the parts cannot be distinguished without a study of their development.

The glomus is not seen in any of the stages described, except as a cluster of cells resembling blood corpuscles may be very rarely found alongside of the aorta. Its origin and development will be discussed later with the further development of the excretory system.

E. R. GREGORY.

Titles of other papers read during the two months: 'The Maturation, Fertilization and Early Cleavage of Myzostoma,' Dr. W. M. Wheeler; 'The Germinal Vesicle in Amphibia' (Carnoy), F. L. Charles; 'Dr. Mead on Annelid Cytogeny,' W. L. Treadwell; 'The Stage of Synapsis in the Squid-egg,' Miss M. M. Sturges; 'The Photospheria of Nyctiphanes with Remarks on the Origin of Luminous Organs,' Dr. S. Watase; 'A Comparative Study of Cell Lineage,' S. J. Holmes; 'Notes on a new Peripatus from Mexico,' Dr. W. M. Wheeler; 'A New Pigeon Hybrid,' Dr. C. O. Whitman; 'Carnoy on the Fertilization of Ascaris,' W. H. Packard.

NEW BOOKS.

Fossil Plants. A. C. SEWARD. Cambridge, The University Press. 1898. Vol. I. Pp. xviii + 452. 12s.

A Text-Book of Botany. E. STRASBURGER, F. NOLL, H. SCHENCK, A. F. W. SCHIMPER; translated from the German by H. C. PORTER, PH.D. London and New York, The Macmillan Company. 1898. Pp. ix + 632. $4.50.

Methods for the Analysis of Ores, Pig Iron and Steel. Easton, Pa., Chemical Publishing Co. 1898. Pp. 130. Paper, 75c.; cloth, $1.00.

The Meaning of Education and other Essays and Addresses. NICHOLAS MURRAY BUTLER. New York and London, The Macmillan Co. 1898. Pp xi + 230. $1.00.

Erratum: On page 468, lines 10 and 11 from the bottom of column 1 the words neurite and dendrite should be transferred.